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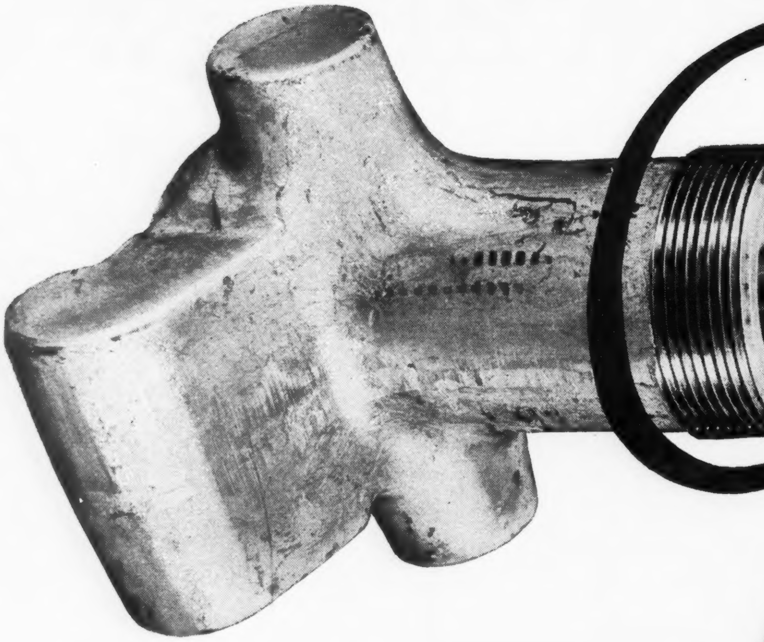

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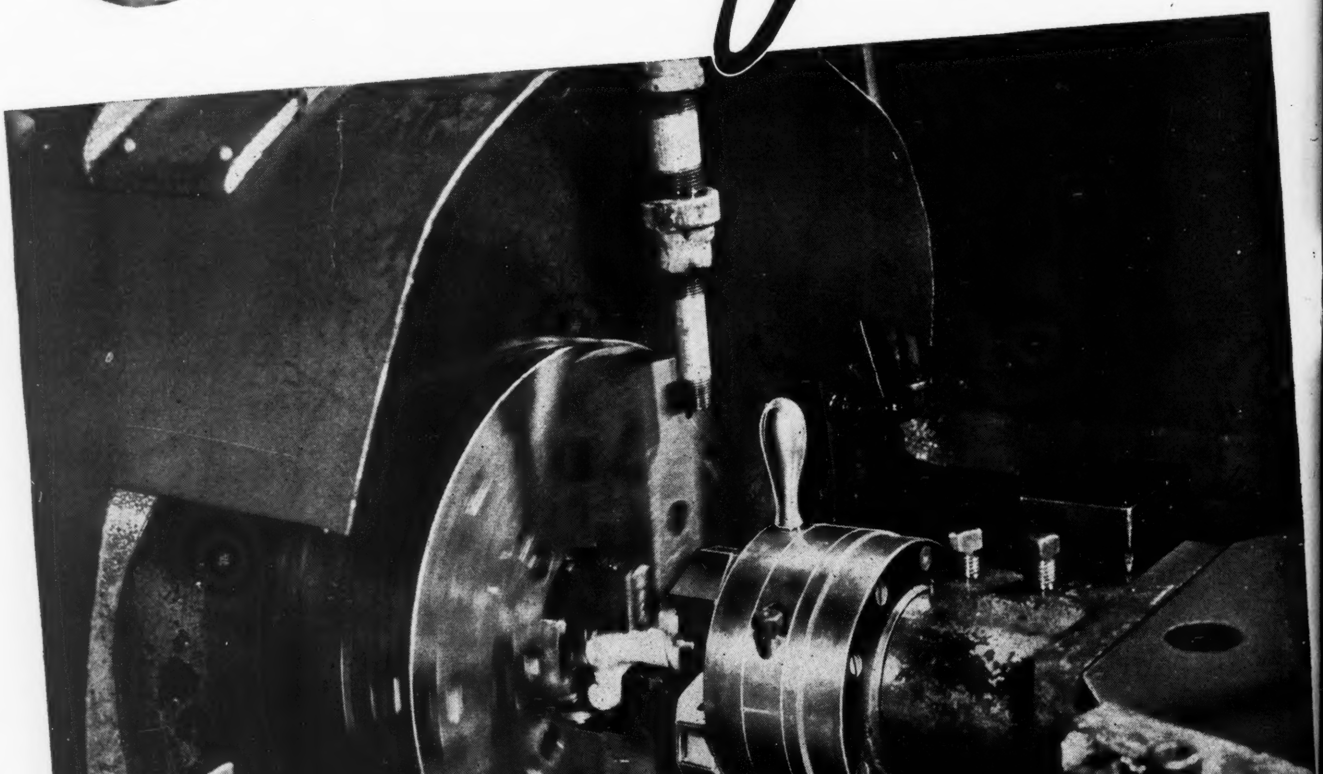

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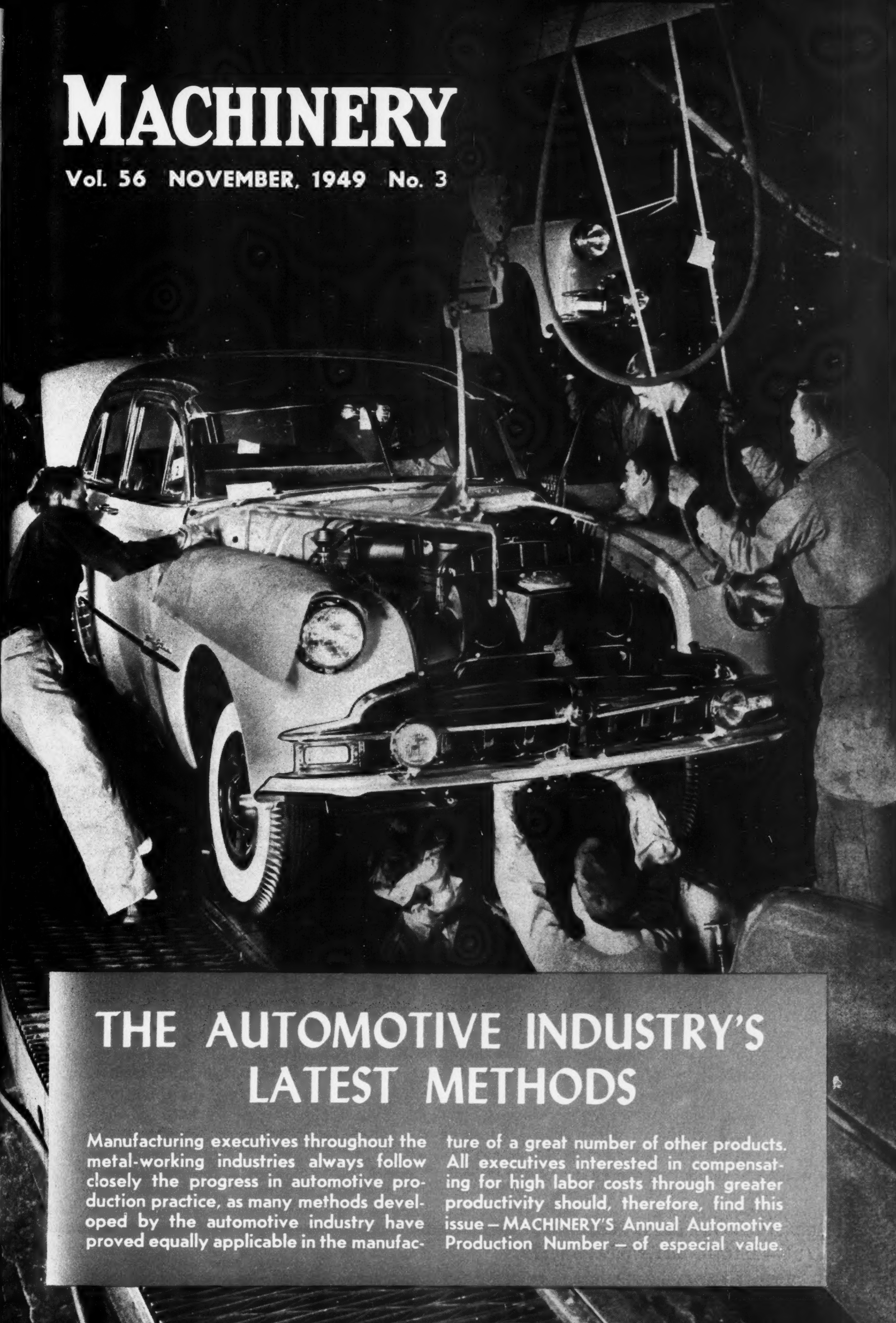


THE AUTOMOTIVE INDUSTRY'S LATEST METHODS

Manufacturing executives throughout the metal-working industries always follow closely the progress in automotive production practice, as many methods developed by the automotive industry have proved equally applicable in the manufacture of a great number of other products. All executives interested in compensating for high labor costs through greater productivity should, therefore, find this issue — MACHINERY'S Annual Automotive Production Number — of especial value.

Forging Techniques in a New Ford Plant

By CHARLES H. WICK

Induction and High-Speed Gas Heating, Multiple and Hot-Extrusion Forging, and Isothermal Annealing are Some of the Latest Methods Employed in Producing One Million Pounds of Forgings per Day

A MILLION pounds of forgings per day for the Ford, Lincoln, and Mercury passenger cars and Ford trucks and tractors are produced at the Ford Motor Co.'s General Manufacturing Division's forging plant, Canton, Ohio, by the application of modern techniques. This plant is equipped with hammers, presses, and upsetting machines ranging in capacity up to 3000 tons. Induction and high-speed gas heating, multiple and hot-extrusion forging, and isothermal annealing are some of the modern forging techniques employed to increase production and improve the quality of the product.

Methods of Heating Billets

While about half of the billet heating at the Canton plant is accomplished with conventional gas-fired, slot type furnaces, the relatively new methods of induction and high-speed gas heating are extensively used for parts on which the scale is not removed in the forging operation. The major advantages of these rapid methods of heating are the relative freedom from scaling, decarburization, and distortion, and the ease with which the equipment can be incorporated in the production line. With higher rates of heating, production can be increased; moreover, the heating can be closely controlled, so that these methods are ideal for selective heating.

In high-speed direct gas heating, a carefully controlled compressed mixture of gas and air burns rapidly in the confined space of ceramic combustion chambers. The heat of combustion is transferred directly to the work by convection or radiation, depending upon the design. Instead of limiting the combustion chamber temperature to the required temperature of the billet, as is the case in conventional furnace heating, the metal is exposed to temperatures well above those desired, thus providing rapid heating from a high-temperature heat source. The heat penetration with conventional methods varies from 1 to 3 inches per hour; with high-speed gas heating, this has been increased to 1 inch in from two to four minutes.

The ends of long steel bars are heated for the high-production forging of drive-shafts by means of Selas high-speed gas furnaces of the vertical conveyor type, such as seen in Fig. 1. This furnace heats 7 inches of the ends of steel bars, 1 1/4 inches in diameter, to a temperature of

2250 degrees F. The bars are carried upward by the conveyor, with one end of each bar passing through the vertical slot in the furnace, and then slide down a discharge chute to the forging press. The temperature of the furnace is 2500 degrees F. Compared with the previous method of heating, fuel consumption and scale formation have been reduced, production has been increased, forging die life lengthened, and operator working conditions improved.

Spindle supports are forged two at a time from billets heated in a Surface Combustion high-speed gas furnace. In Fig. 2 an operator is shown removing a hot billet from the discharge end of this pusher type furnace. The blanks are moved through the furnace along rails by an automatic pushing mechanism that is actuated by a motor-driven cam. Burners are so arranged along the walls of the furnace that the flames swirl around the blanks. This sweeping action of the flames insures rapid, uniform heating. A production of 500 blanks per hour is obtained.

In induction heating, heat is generated in the forging billet by its resistance to the flow of electrical current induced by a high-frequency current passing through a coil surrounding the billet. Power is supplied to the twenty-seven induction heaters used in this plant by means of motor-generator sets having sensitive voltage regulating systems. Most of these sets generate 3000-cycle current at 800 volts, while a few produce 960-cycle current.

The capacity of the induction heaters is from 200 to 700 K.W., some of the larger units being connected in parallel to heat large billets. The inductor coils that surround the billets are made from oval or square cross-section copper tubing through which cooling water is passed.

Although the initial cost of induction heating equipment is greater than that required for other methods of heating, it is generally preferred where scale-free billets are essential. Also, the time required for heating any given size billet by the induction method is less.

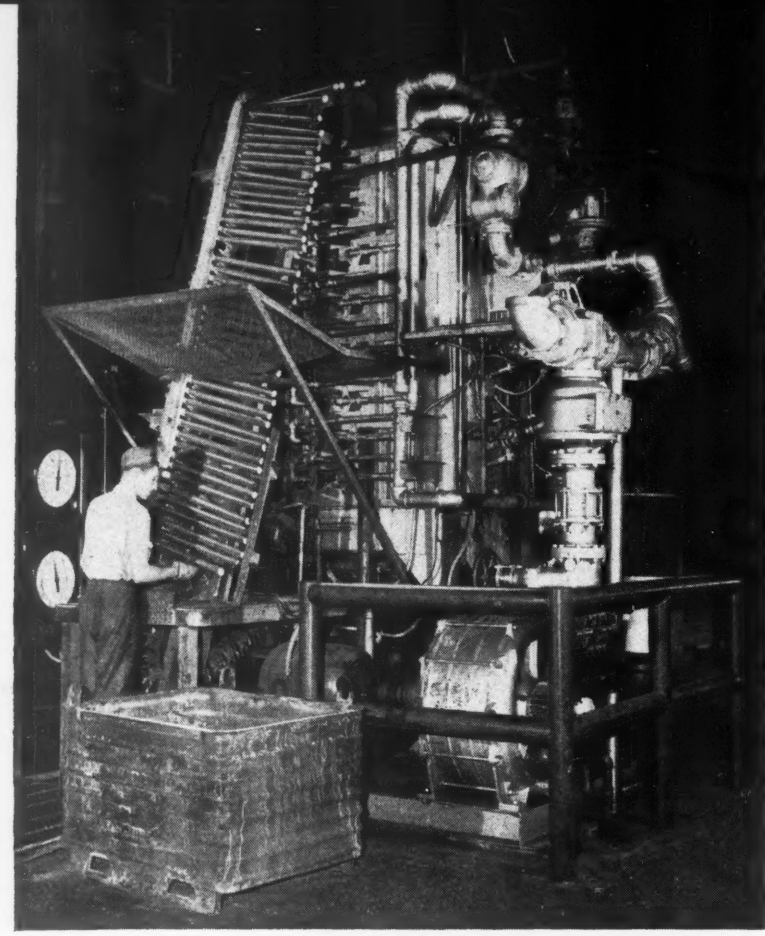


Fig. 1. Vertical conveyor type of high-speed gas furnace employed to heat the ends of long steel bars preparatory to forging

A salt bath furnace is also used for selective heating of billets. Round billets, from 1 3/16 to 1 7/8 inches in diameter and 8 to 21 inches long, are suspended vertically from a conveyor passing over the salt bath. The end of the billet projecting into the salt is heated to 2300 degrees F. in less than twenty seconds. Although this is a relatively costly method of heating, close uniformity of temperature is obtained, and the protective action of the salt produces a scale-free surface on the billet. Another method of partially heating billets is by resistance heating. A section 3 inches long, 2 inches from one end of the billet 7/8 inch in diameter by 16 inches long over all, is heated to 2300 degrees F. in 7 1/2 seconds on a converted, 150-K.W. resistance welding machine.

High-Production Forging of Gear Blanks

Hypoid driving-gear blanks are press-forged from S A E 8620 steel at the rate of 286 per hour. Round-cornered billets such as shown at *A* in Fig. 3, 3 1/4 inches square by 4 5/8 inches long, are heated throughout to a temperature of 2250 degrees F. in a Budd continuous type induction heater. The billets are loaded manually into the magazine at one end, and the heated billets are automatically ejected from the opposite end on a conveyor leading to the forging press. To insure through heating of this large billet, the furnace is divided into two zones. The first zone, consisting of a 325-K.W. heater heats the outside of the billet to the desired temperature, while the second zone (a 175-K.W. heater) maintains this temperature until the heat penetrates to the core of the billet. The heating cycle is 13 1/2 seconds per billet. Two furnaces serve each forging press.

A three-impression die, mounted on the Ajax 2500-ton forging press shown in Fig. 4, is employed to produce the driving-gear blanks. A forging is seen being removed from the finishing impression of the die in Fig. 5. Progressive shapes formed in the die impressions are illustrated at *B*, *C*, and *D* in Fig. 3. A die life of about 10,000 parts is being obtained. The forgings are hot-trimmed on a Bliss press to produce the shape seen at *E*.

Isothermal Annealing Improves Machinability

Machinability of driving-gear blanks and other forgings has been improved considerably by the application of isothermal annealing directly following the forging operation. This

process involves a relatively fast transfer of the parts from the forging press to a salt bath that is maintained at a sub-critical transformation temperature, predetermined for the particular steel being annealed. Isothermal annealing, sometimes called salt bath annealing for this particular application, is based on the isothermal transformation diagram (S curve), which depicts the ability of a steel to form various structures during cooling or while being held at any sub-critical temperature.

Forgings that have been annealed by the isothermal process, with accurate control of both time and temperature, have a uniform hardness, a relatively large grain size, and a stress-relieved pearlitic structure with machining qualities considerably superior to those of the structures obtained by conventional methods of annealing or normalizing. Formerly, ring-gear blanks were normalized to improve their machinability; however, it has been found that salt bath annealing not only improves the machinability of the gear blanks, but also minimizes residual stresses in the blanks, lessening the tendency of the machined gears to "unwind" or distort during the subsequent hardening operations. Although isothermal annealing is not new, Ford's installation at the Canton plant is believed to be the first extensive and successful application in a high-production industry.

This type of heat-treatment to improve the machinability of rough forgings is being used principally for gear steels, such as S A E 5135 and 8620. The process is not applicable to all steels, since the transformation rate of the steel must be such that transformation occurs in a relatively short time. Parts now being treated in this way include the hypoid driving gear, driving pinion, differential gear, transmission main drive gear, and transmission countershaft cluster gear.

A neutral heat-treating salt containing from 25 to 35 per cent potassium chloride, 50 to 55 per cent barium chloride, and the remainder sodium chloride is employed for isothermal salt-bath annealing. The salt has a melting temperature of 1050 degrees F. and is heated to 1190 degrees F. for annealing the driving-gear blanks. Desludging is performed once every twenty-four hours by scraping the bottom of

Fig. 2. Discharge end of a pusher type high-speed gas furnace. Each heated billet is forged into two spindle supports

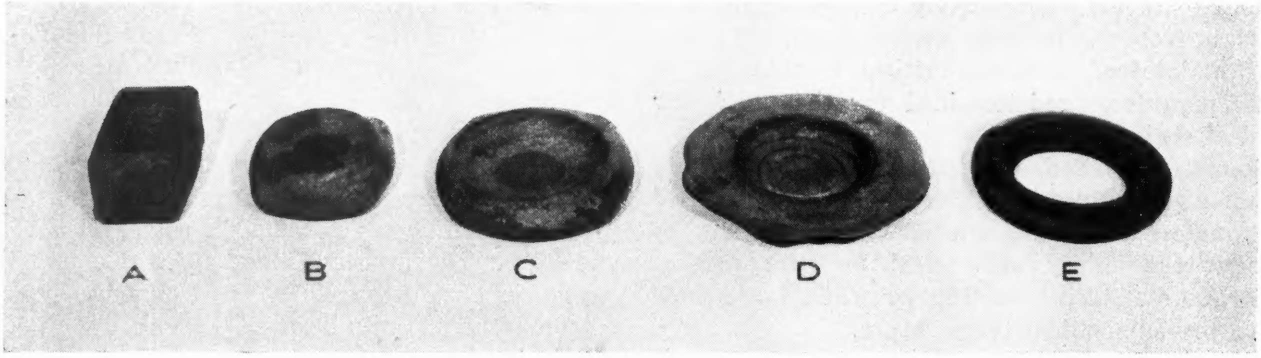


Fig. 3. Progressive shapes formed in forging and hot-trimming hypoid driving-gear blanks from billets such as seen at (A)

the furnace. The salt bath furnaces used for this operation were provided with mechanization features designed and installed by Ford engineers.

Rapid transfer conveyors carry the forgings from the hot trimming press to the salt bath furnace, so that they can be placed in the salt bath before they cool below 1650 degrees F. (the upper critical zone). This is of considerable importance in order that the austenitic structure developed in the forging operation be maintained, so that the transformation to pearlite and ferrite will occur only at the annealing temperature. If the forging is allowed to cool below the upper critical range of the material, ferrite would begin to precipitate prior to "quenching" the stock in the salt bath, producing a structure that would not have a high degree of machinability. Prior to being placed in the salt bath, the forgings are checked by radiant

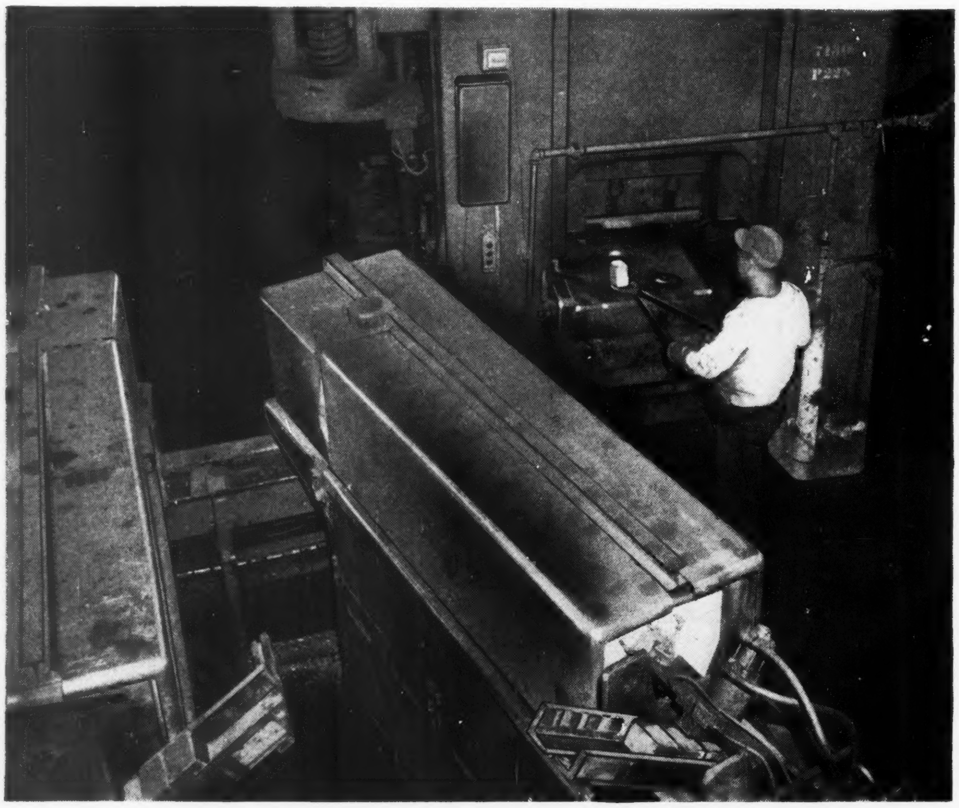


Fig. 4. Billets for the driving-gear blanks, Fig. 3, are forged in a three-impression die mounted on this 2500-ton press

type potentiometers, Fig. 6, to insure that they are at the proper temperature. By annealing the forgings while they are still hot, the residual heat is utilized in maintaining the desired annealing temperature of the salt bath, thus effecting considerable saving in the electrical power required for heating.

For the annealing operation, the operator places the hot forgings in a special work-holding mesh type basket made from a heat-resistant steel, which accommodates two rows of gear blanks, with twelve blanks in each row. Arrangement of the work in the baskets is important to insure uniformly controlled cooling by allowing the circulating salt to contact all surfaces. The basket is automatically lowered into the salt and a walking-beam type mechanism pulls the baskets through the bath.

Forged parts remain in the salt bath until the isothermal transformation is completed. The cycle for the driving-gear blanks varies from forty to fifty-five minutes, depending upon the analysis of the particular heat of steel from which the blanks were forged.

At the completion of the cycle, the basket swings on a trunnion arm, dropping the blanks out on a chute leading to an automatic dumper. The dumper dips the parts into a water tank for a two-second "flash quench," and then empties them into a shipping container, Fig. 7. The work-holding baskets are then automatically returned to the loading end of the furnace. The only purpose of the water dip is to wash the salt from the annealed forgings, since either air cooling or water quenching is satisfactory, once isothermal transformation has been completed.

Most salt-bath annealed parts do not require subsequent cleaning, as is the case with forgings normalized in the conventional manner. If the stock is badly scaled prior to forging, the scale may be "coined" into the part. In such a case, the scale cannot be removed by salt-bath annealing, and the forgings must be pickled or cleaned. The water dip cleans adhering salt from the part, producing a surface suitable for machining. Distortion or warpage previously encountered in subsequent hardening of the forgings has been

Fig. 5. Forged driving-gear blank being removed from the finishing impression of the die used on the press illustrated in Fig. 4

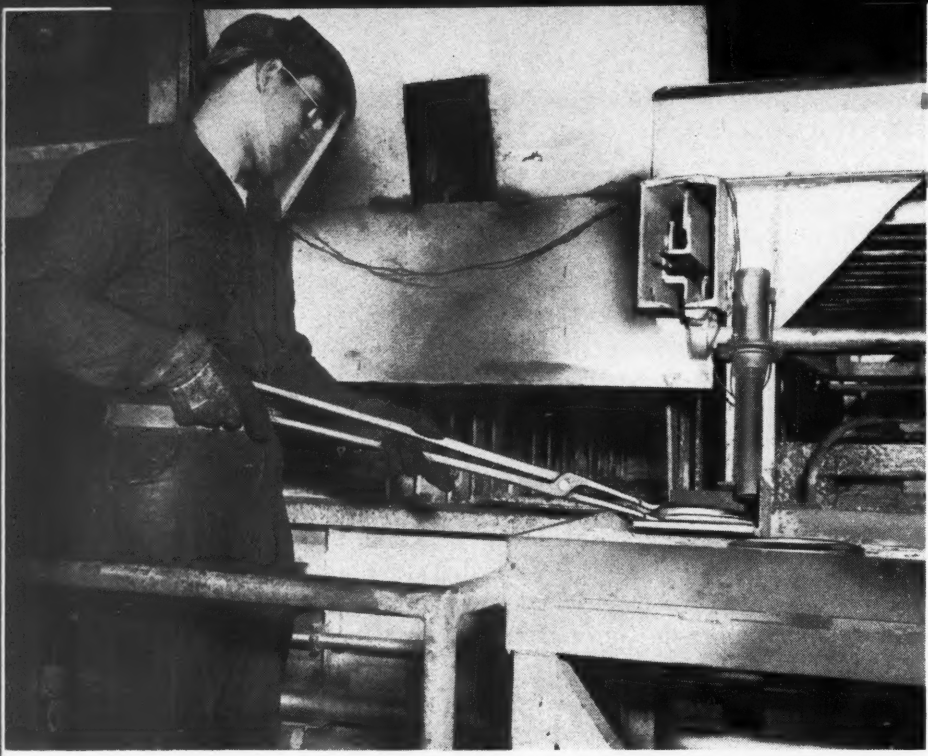
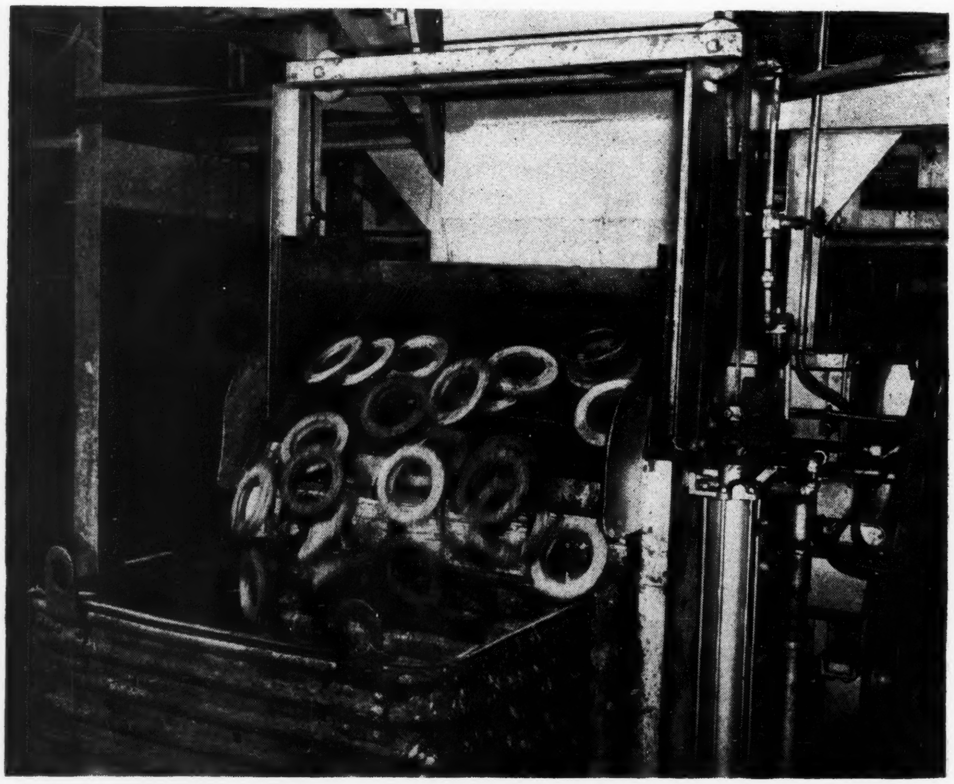


Fig. 6. (Left) The temperature of the hot-trimmed forgings is checked by means of a radiant type potentiometer before isothermal annealing

Fig. 7. (Right) At the completion of the isothermal annealing cycle, the forgings are "flash quenched" in water and automatically dumped into a container



reduced to a minimum, thus effecting considerable savings by eliminating straightening and regrinding operations.

Multiple Forging of Connecting-Rod Caps

Connecting-rod caps are forged ten at a time from S A E 1038 steel billets, 1 13/32 inches in diameter by 18 inches long. The present production is 1493 caps per hour from each forging press. After the steel bars have been sheared to the required lengths, the billets are loaded into magazines on the two Budd induction furnaces seen in the heading illustration. Two furnaces serve one forging press, each furnace consisting of two 200-K.W. induction heaters connected in parallel. The billets are automatically fed through the inductor coils, and ejected after a

thirteen-second heating cycle, which brings them to a temperature of 2250 degrees F.

A double-impression (blocking and finishing) die, mounted on the 2500-ton National "Maxipres" illustrated in Fig. 8, is used for forging the connecting-rod caps. Progressive shapes formed are seen in Fig. 9, with round billet *A*, blocked forging *B*, finished forging *C*, partially trimmed forging *D*, and cold-trimmed caps *E*. The forging die is made from a steel containing from 0.55 to 0.60 per cent carbon, 0.45 to 0.60 per cent manganese, 0.70 to 0.80 per cent chromium, 2.25 to 2.45 per cent nickel, and 0.75 to 0.80 per cent molybdenum. The die life is equivalent to approximately 55,000 caps. Forging tolerances are held to + 0.030 inch, — 0.010 inch.

The connecting-rod caps are cold-trimmed five at a time, the forgings dropping through the bottom of the press on a conveyor and the trim flash being dropped on another conveyor. Forgings are then hardened by heating to 1500 degrees F. and quenching in a caustic solution maintained at 85 degrees F. A drawing operation performed at 960 degrees F. results in a Brinell hardness range of 285 to 321. Following the heat-treating, a Magnaflux inspection is performed to check for quench cracks, and the caps are then cleaned by a blasting operation.

Hot Extrusion of Front Wheel Spindles

Extrusion forging differs from conventional forging in that the heated metal is confined in a die, so that it can only flow into the shape desired. When the design of the forging is such that it can be extruded, considerable savings can be made by the use of this process in the amount of steel used, number of machines required, labor, floor space, and die costs. Also, an improved product is generally obtained because of the increased strength for equal sections resulting from ideal fiber flow in the metal. An excellent example of the application of the hot extrusion method is in the production of front wheel spindles such as shown in Fig. 10.

Front wheel spindles are produced from S A E 5132 steel bar stock. Considerable experimentation was necessary to determine the most economical billet shape that would produce satisfactory extrusions. After a number of shapes

Fig. 8. Connecting-rod caps are forged ten at a time by means of a blocking and finishing die mounted on a 2500-ton forging press

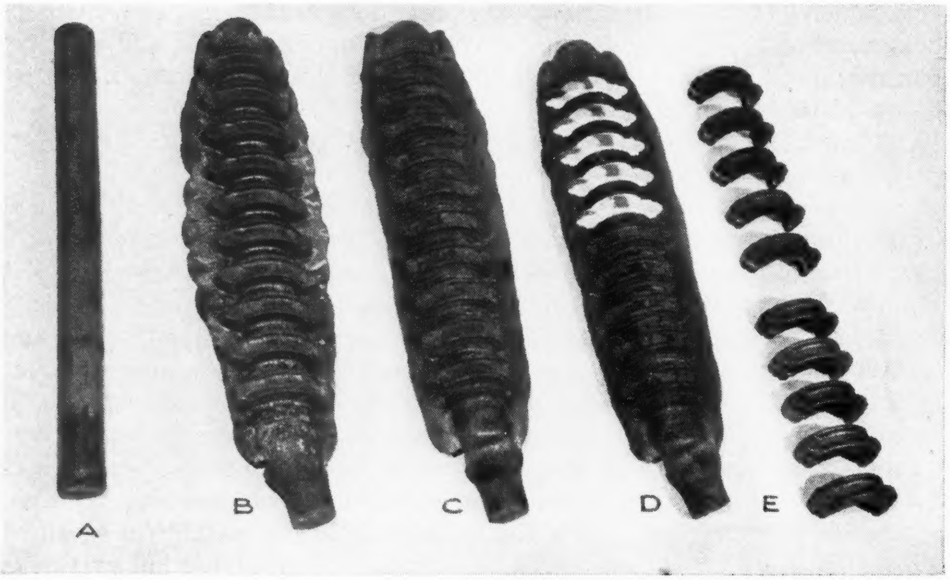


Fig. 9. Connecting-rod caps (E) are press-forged ten at a time from round billets such as seen at (A)

had been tried, including rectangular and spherical, it was determined that billets cold-sheared from round bar stock 2 1/2 inches in diameter were the most satisfactory. This shape makes the billet self-locating in the die. Also, because it is placed horizontally in the vertical acting press, the punch first contacts only a small area on the billet, so that a minimum of "plastic inertia" need be overcome.

The billets are sheared to a length of 3 15/16 inches from bars approximately 20 feet long, providing a billet weight of slightly less than 5 1/4 pounds. Billets are loaded into an Ajax continuous induction heater, where they are heated to 2250 degrees F. at the rate of 400 per hour. The production of this heater is 750 per hour, but its output must be reduced to match the production of the extrusion press.

Following the induction heating, the billets are automatically ejected into a chute that carries them within reach of the press operator. The operator transfers the billet to the extruding die by means of tongs. A 1200-ton "Maxipres," made by the National Machinery Co., is employed for this operation, as shown in Fig. 11. The rate of production is 400 spindles per hour.

Several die materials having various hardnesses were tried to obtain the most satisfactory die life in the extrusion of the wheel-spindles. Dies made from the tungsten type, hot-work steels, hardened to about 50 Rockwell C, failed in service due to heat checking. Dies of the

Fig. 10. Progressive shapes formed in producing front wheel spindles. A billet is seen at (A), the extruded forging at (B), a hot-trimmed spindle at (C), a coined or restruck spindle at (D), and a spindle that has been cold-trimmed to length at (E)

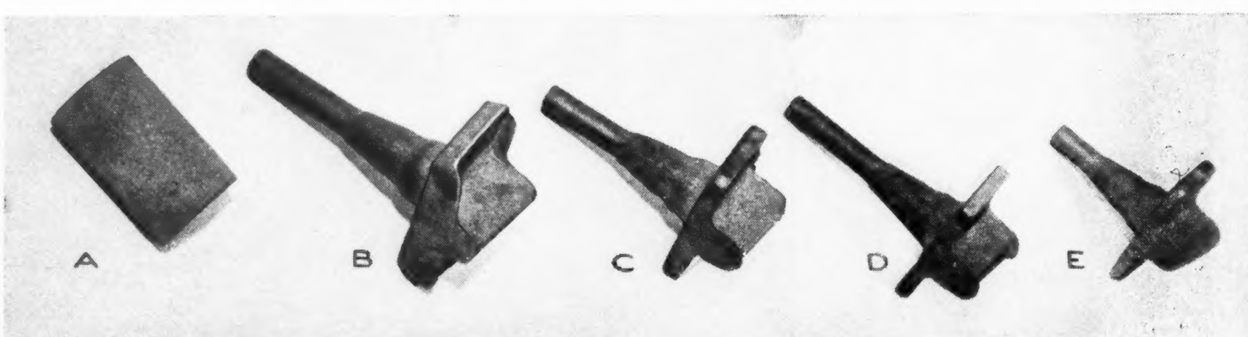


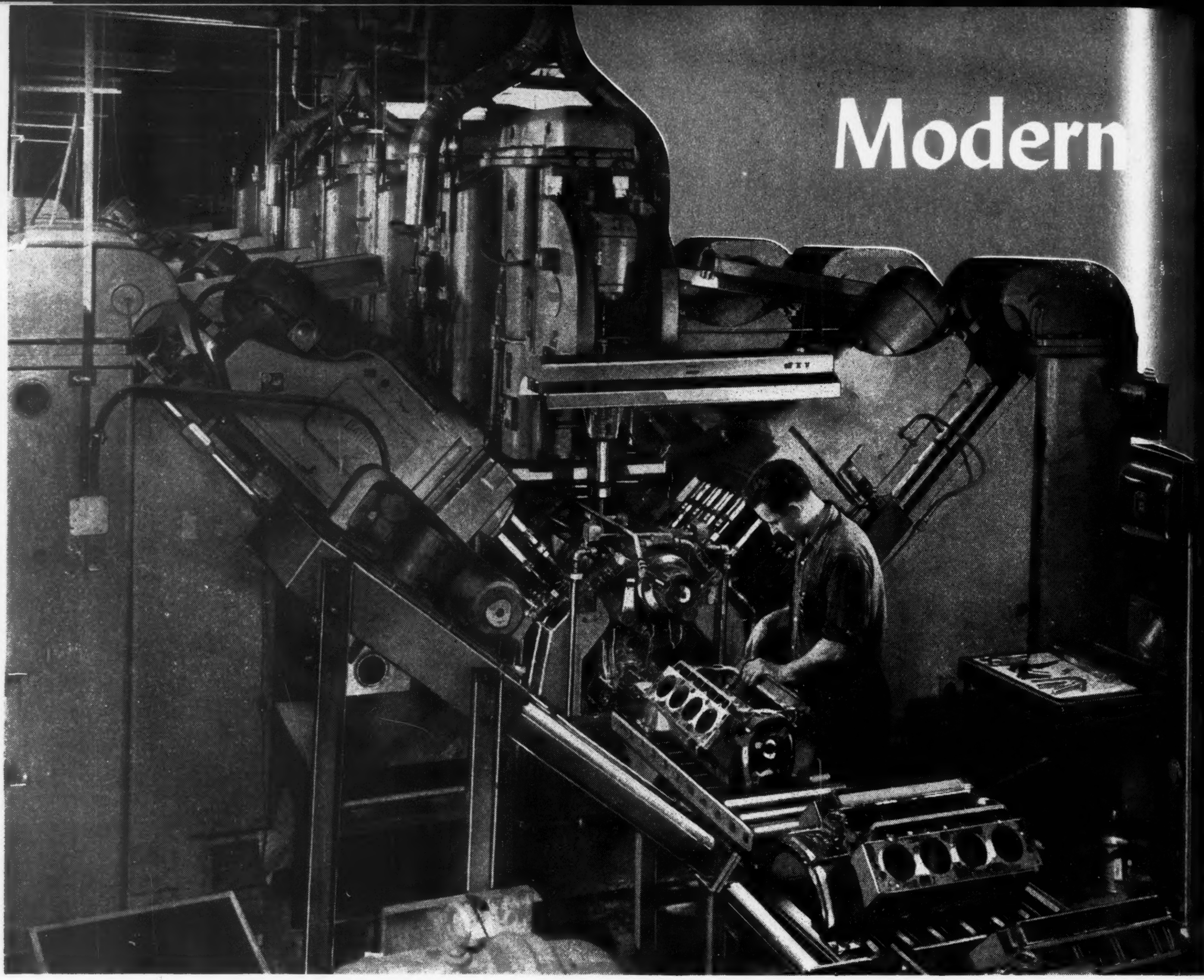
Fig. 11. Extruded forgings for front wheel spindles are produced at a rate of 400 per hour from round billets, 2 1/2 inches in diameter by 3 15/16 inches long

nickel-chromium-molybdenum type failed by "washing out" and losing their form. Hard-facing materials were welded to the working surfaces of the punches, but most of the hard-facing material checked and crumbled. Finally, a successful material was developed containing from 0.30 to 0.35 per cent carbon, 0.25 to 0.35 per cent manganese, 4.8 to 5.1 per cent chromium, 1.2 to 1.5 per cent tungsten, and 1.6 to 1.8 per cent molybdenum. Die inserts of this material, heat-treated to a hardness of 50 Rockwell C, are producing about 3500 wheel-spindle extrusions, while the punches stand up for about 1800 parts.

The high production of extrusions in this operation does not permit enough time for the heat to be conducted away from the die surfaces, and it is necessary to use some method of cooling. A spray of air and water directed on the punch and die between each stroke of the press serves to cool the die, and also to blow off scale or foreign matter. Between each operation, the die is also swabbed with a compound consisting of 60 per cent (by weight) machine oil, 25 per cent Brookes compound, and 15 per cent Ceylon plumbago.

Extruded forgings are hot-trimmed in a die mounted on a Toledo press. The hot-trimmed extrusion drops through the die onto a conveyor that carries it to a hot restrike operator. Hot restriking is performed on a Bliss press. The stem of the wheel-spindle is cold-trimmed to the correct length on a Ferracute press. Extrusions are then snag-ground on Hammond double-end grinders, after which they are inspected visually. Following this operation, the wheel-spindles are ready to be installed in passenger cars.

The billet used in extrusion forging weighs only 5 1/4 pounds, which represents a material saving of 30 per cent compared with previous methods of forging, or approximately 10 tons of steel per day. In addition, a saving of twenty machines and 4000 square feet of floor space has been effected by extruding the wheel-spindles. The number of operators required has been reduced from 46 to 16—a labor saving of 65 per cent for the same production schedule. The improved flow pattern of the extruded metal produces a stronger wheel-spindle, having an average fatigue life 17.3 per cent greater than forged spindles. Estimated savings in die costs amount to about 40 per cent.



ONE objective in designing the new Cadillac V-8 engine was to obtain the highest compression ratio possible, compatible with available gasolines. A compression ratio of 7.5 to 1 was decided upon, but provision was made for obtaining ratios up to 12 to 1 with the same basic design of engine and without major machinery or tooling changes. Most components of the engine have been redesigned to reduce the weight and dimensions, and provide smoother operation, increased performance, and greater durability. Outstanding examples of the modern tooling employed in producing this engine are described here.

All four crankpins on the crankshaft are machined and the adjoining counterweight walls are faced in one operation on the Gisholt "turn-milling" machine seen in Fig. 1. Almost 10 pounds of metal are removed from the S A E 1145 steel forging in this operation. The production is 103 crankshafts per eight-hour shift from one machine. Stroke and radial location of the crankpins are maintained within 0.008 inch, axial location within 0.010 inch, and crankpin diameters to $\pm$ 0.010 inch of the desired size. Finish-grinding of the crankpins is the only subsequent operation required. The counterweight walls or cheeks require no further machining.

In this machine, the crankshafts are chucked on their two outer main bearings, which have previously been machined. The correct radial location of the counterweights is obtained by stop-buttons on the chucks. Two steadyrests with carbide inserts also support the crankshaft on its main bearings during the machining operation. Four inserted-blade milling cutters (Fig. 2), 24 inches in diameter and containing forty-two carbide blades, are individually driven by a 50-H.P. motor. The cutter blades are staggered, so that one blade will machine one counterweight wall, or cheek, and about two-thirds of the crankpin surface, while the succeeding blade machines the opposite cheek and two-thirds of the crankpin.

Tooling Methods Employed in Building Cadillac's High-Compression Engine

By F. M. PRUCHA
Superintendent, Methods and Equipment Division
Cadillac Motor Car Division
General Motors Corporation
Detroit, Mich.

"Turn-Milling" of Crankshafts, Transfer-Machining of Cylinder Heads and Blocks, and Unique Precision Boring Set-Ups are Features of the Tooling Employed in Producing Cadillac's New High-Compression V-8 Engine

The milling cutters are rotated at 67 R.P.M., corresponding to a surface speed of 420 feet per minute. Cams mounted on the work-rotating spindle control the movements of the milling cutters through hydraulic means acting on the cutter-slides. The four crankpins and their adjacent counterweight faces are each "turn-milled" by one of the cutters. The two centrally located cutters move in a vertical plane, while the two outside cutters move horizontally, toward and away from the work. The cutter at the left also moves in a sidewise direction to facilitate loading and unloading.

Cutters are plunge-fed to depth, and only one revolution of the crankshaft is necessary to complete the operation. Depth of cut varies from 5/32 to 3/16 inch. The cutter blades are carefully ground with a 10-degree positive axial rake, a 5-degree radial rake, and a nose radius of 3/64 inch. Sharpening is accomplished by means of the Oliver automatic grinder seen in Fig. 3. With this equipment, it is only necessary to clamp the cutter on a faceplate, after which the machine automatically indexes and grinds each tooth in succession until the cutter is completely sharpened. A cam mounted on the machine controls the tooth shape. Cutter life averages 205 crankshafts per cutter sharpening.

The main bearings of the crankshaft and their adjoining cheeks are also machined in one operation by the use of another Gisholt "turn-milling" machine, Fig. 4. This operation is simpler than the machining of the crankpins because the bearings are all in line and it is not necessary to have the cutters move with relation to each other. Production obtained from this machine is 150 crankshafts per eight-hour shift, and the bearing diameters are held to within ± 0.005 inch of the desired size.

The design of the new high-compression engine, with its additional counterweights and shorter length, made single-point turning difficult. With the "turn-milling" method, spacing between the bearings is easier to control, as there are fewer cutters, and the fluted surface produced by the cutters provides longer grinding wheel life in the subsequent finishing operation. Both "turn-milling" machines have been operating on three shifts since the introduction of the model.

Fig. 1. "Turn-milling" machine employed for roughing all four crankpins and finish-facing the counterweight walls, or cheeks, of the crankshafts in one operation

One of three Footburt, ten-station transfer machines employed for progressively machining the cylinder heads of the engine is seen in Fig. 5. Previous operations performed on the hard cast-iron heads are milling of the top and bottom surfaces and drilling and reaming of the two location holes. Approximately 0.010 inch of stock is left on the gasket face (bottom) of the cast head for a subsequent finish-milling operation.

After the castings have been loaded into the machine at the first station, seen in the foreground, they are slid along rails by means of a hydraulically actuated transfer bar. Fingers projecting downward from the bar push the heads from station to station. After each progressive transfer, the bar is rotated so that the fingers will clear the work, and is then returned to its original position. At each station, the casting is pushed against locating dowels on the machine, and rigidly clamped by hydraulic means.

Cored combustion chambers in the cylinder heads are machined at the second and third stations of the machine by the formed carbide blades of shell end-mills mounted on angularly positioned spindles. At subsequent stations (Fig. 6) more than fifty holes are drilled, the valve seats are counterbored, spark-plug holes

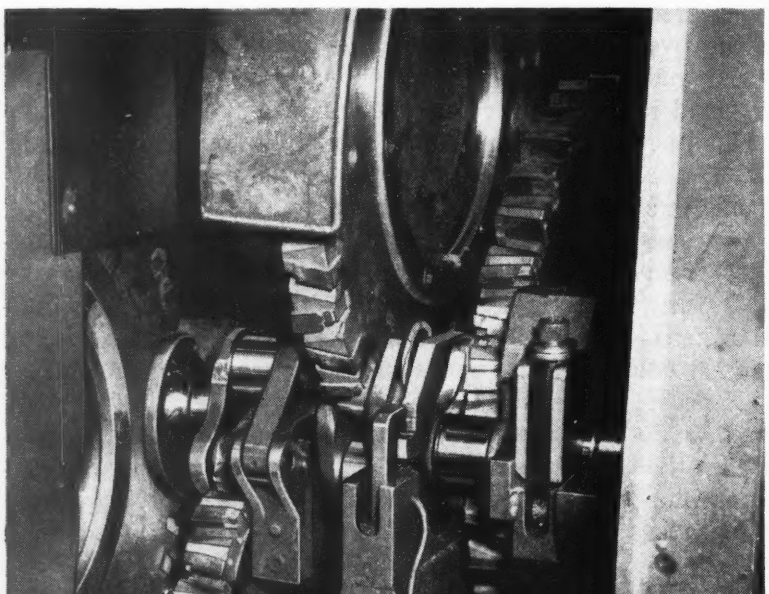


Fig. 2. Close-up view of the four milling cutters used on machine seen in Fig. 1. Each cutter is 24 inches in diameter and contains forty-two inserted carbide blades

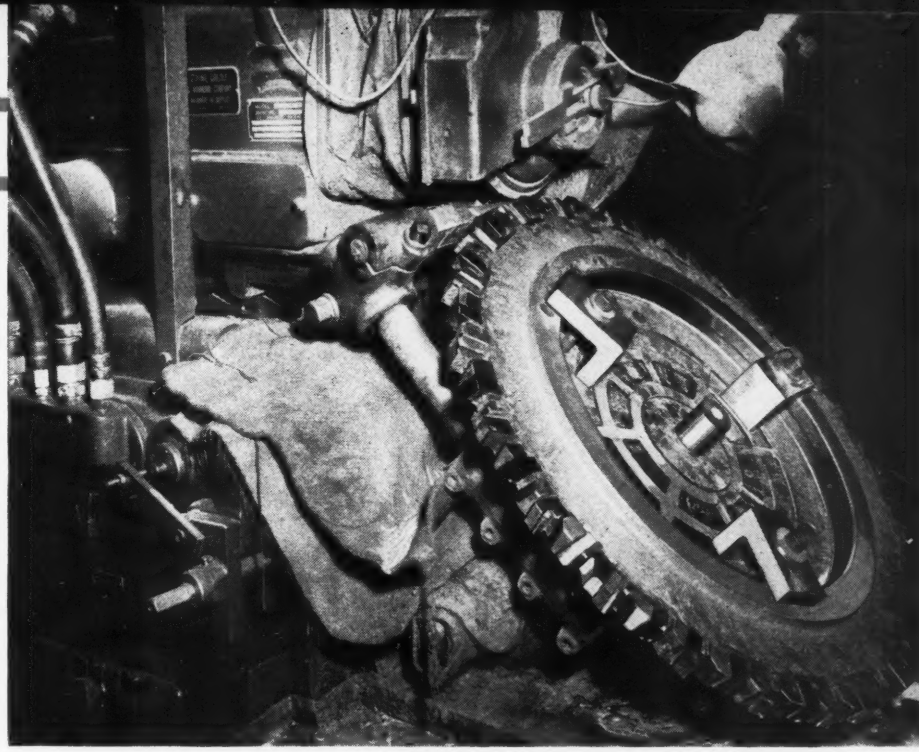


Fig. 3. The crankshaft "turn-milling" cutter is automatically indexed and each carbide tooth is ground to desired shape on a cam-controlled sharpening machine

are faced and counterbored, spring seats are spot-faced, and valve-guide holes are reamed.

The second ten-station Footburt machine taps many of the holes in the head, while the third machine completes the drilling and tapping operations required. The third transfer machine is of the double indexing type, with double station movement of the transfer bar and castings to permit handling both right- and left-hand heads.

Drills on all three machines operate at a speed of 71 surface feet per minute, with a feed of about 0.007 inch per revolution, while reamers are rotated at a speed of 60 feet per minute, with a feed of 0.016 inch per revolution. The taps are mounted on individual lead-screw spindles, and revolve at 40 surface feet per minute. A production rate of fifty cylinder heads per hour is obtained from each machine. Screw type conveyors pass through the bases of all three machines to facilitate chip removal.

Valve-guide bushing holes in the cylinder heads are finish-bored, valve seats are finish-faced to a 45-degree angle, and counterbores are formed under the valve seats on the New Britain four-spindle precision boring machine shown in Fig. 7. Two of the spindles are tooled to machine the exhaust-valve hole and seat, while the other two machine the intake valve. By means of a special fixture which permits indexing the cylinder head through an angle of 180 degrees, all eight valve holes and seats in each head can be finished in two passes without changing the set-up. Thus close concentricity between the valve seats and the valve-guide bushing holes is ob-

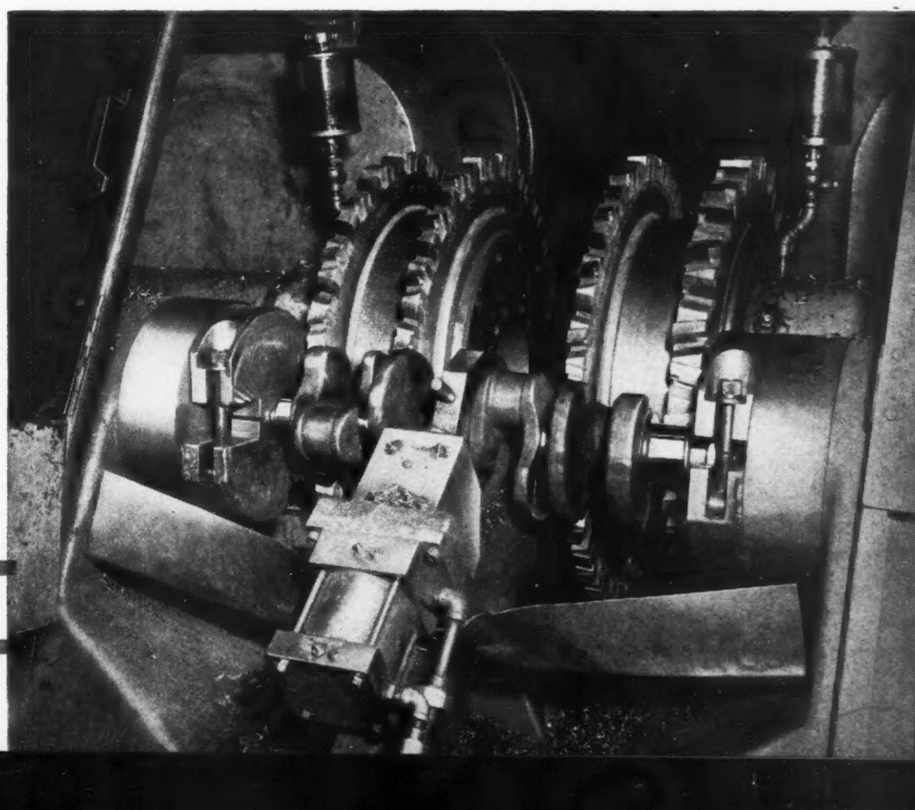


Fig. 4. Main bearings of the crankshaft and the adjoining cheeks are machined on this "turn-milling" machine at the rate of 150 crankshafts per eight-hour day

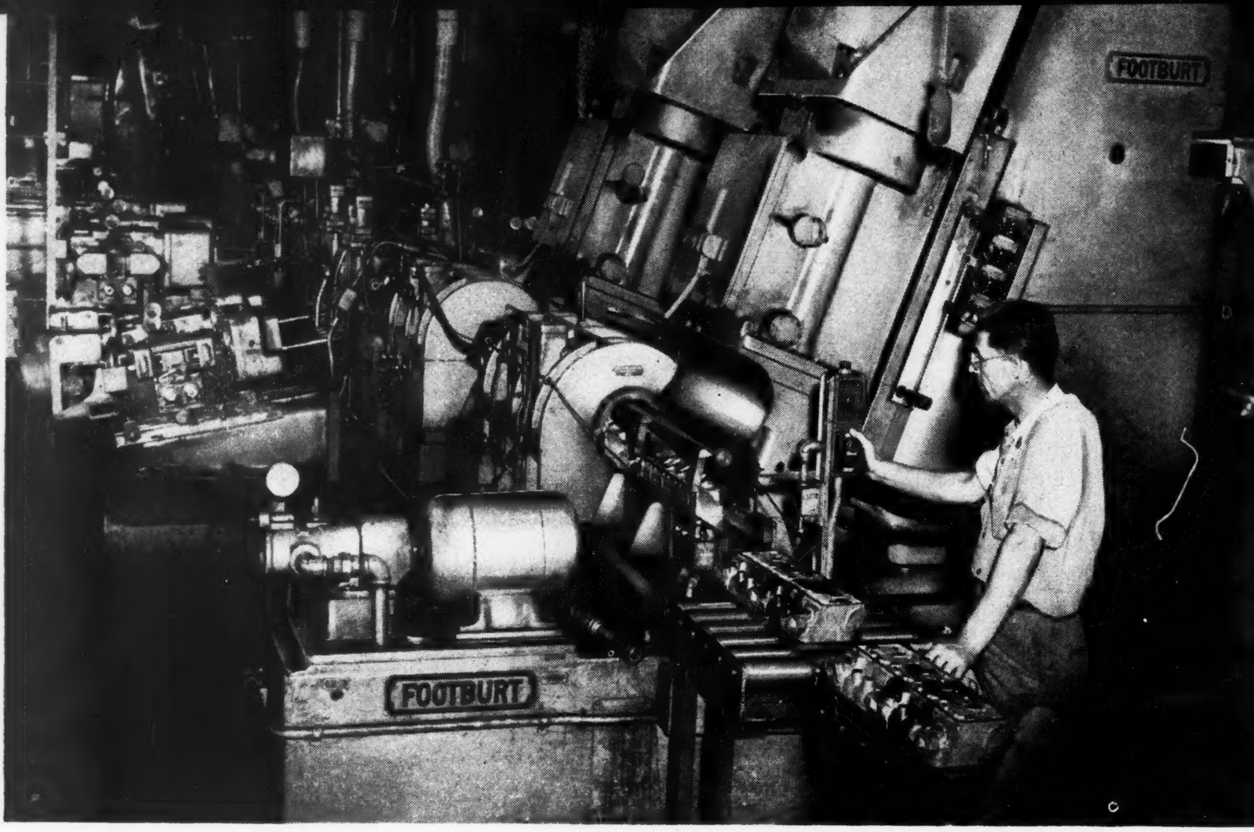


Fig. 5. Ten-station transfer machine employed for milling, drilling, counterboring, facing, and reaming cylinder heads at the rate of fifty per hour

tained. The production rate is forty-one parts per hour.

Each spindle is provided with three single-point solid carbide tools—a boring tool, a counterboring tool, and a valve-seat generating tool. For boring and counterboring, the spindle feed is 0.0035 inch per revolution and the speed 2600 R.P.M. At the completion of these cuts, the spindle speed is reduced to 1300 R.P.M., and the valve-seat generating tool is mounted on a pivot-fed cross-slide, which is actuated by a draw-bar in the hollow spindle. Approximately 0.025 inch of stock is removed from the various diameters, the size being held to within ± 0.0005 inch and the concentricity to 0.001 inch. Tools require sharpening after producing about 150 cylinder heads.

Cylinder blocks for the V-8 high-compression engine are drilled, reamed, chamfered, and counterbored on the special Baush transfer machine seen in the heading illustration. The unit consists of six independent machine tools connected by a hydraulically actuated transfer mechanism. There are 208 spindles on the complete unit, and

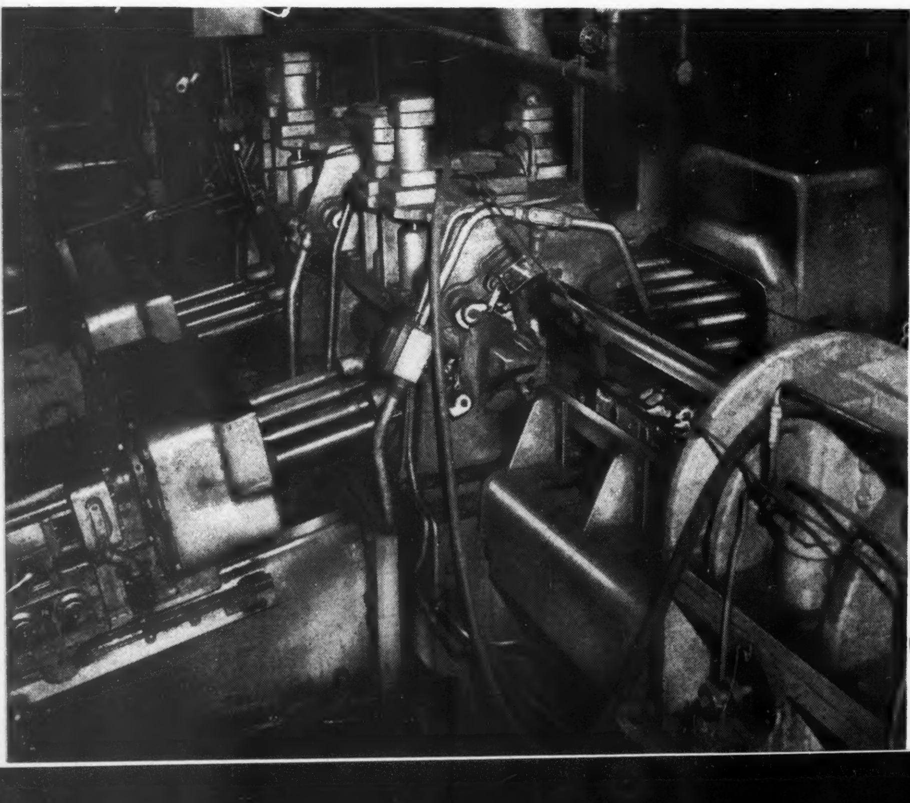


Fig. 6. Close-up view of fourth and fifth stations on machine seen in Fig. 5, showing the hydraulic transfer bar with its projecting fingers for sliding the heads from station to station

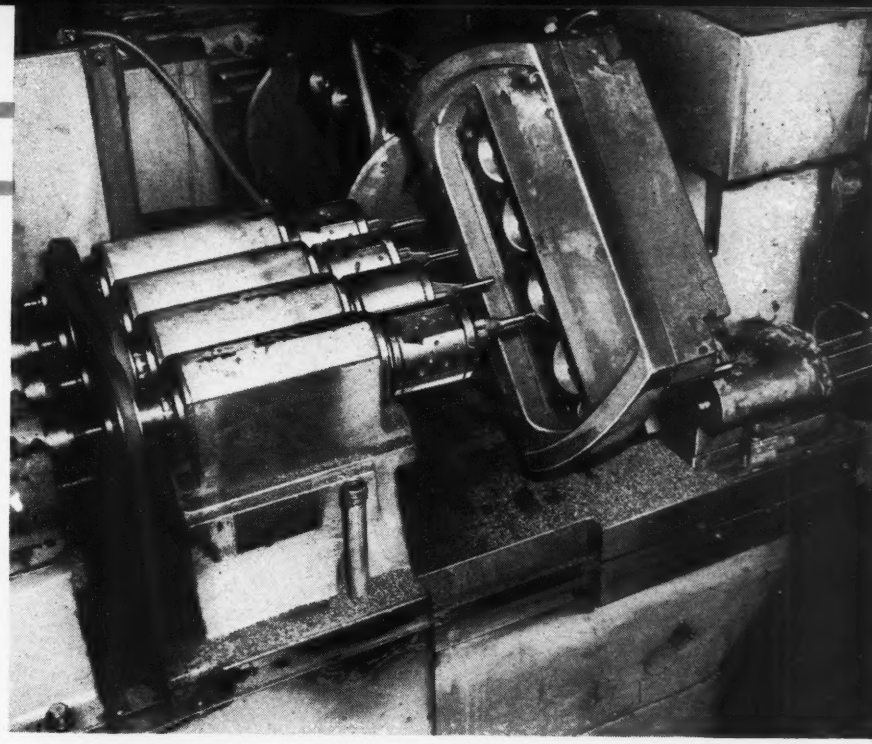


Fig. 7. Concentricity of the valve-guide bushing holes with relation to the valve seats in the cylinder heads is insured by boring both on this four-spindle machine

the total production is twenty-six cylinder blocks per hour.

The first machine contains two angular heads, each having four spindles, and a single-spindle vertical head for counterboring six expansion plug holes, drilling two water drain holes, and spot-facing a 1 1/8-inch diameter distributor hole. On the second machine, both right- and left-hand angular heads having twenty-one spindles are used for drilling twenty-six water circulation holes and sixteen tappet holes. A single-spindle vertical head on this machine chamfers the distributor hole. The third machine is equipped with twenty-one spindles for chamfering the tappet holes, counterboring and chamfering four cylinder-head dowel-holes, and drilling the oil-pump shaft hole.

Both the fourth and fifth machines have twenty-spindle, right- and left-hand angular heads, and a seventeen-spindle vertical head. Here thirty-four cylinder-head screw-holes are drilled to the required depth, the distributor hole is rough-reamed and spot-faced, sixteen oil and tappet holes are drilled, and a flat spot is milled in each of the sixteen tappet holes. The sixth machine has ten spindles on both right- and left-hand heads and a vertical head for finish-reaming the sixteen tappet holes, the four cylinder-head dowel-holes, the distributor hole, and the oil-pump shaft hole.

Drills on this transfer machine rotate at 70 surface feet per minute, and reamers at 60 feet per minute. Feed rates are about 0.008 inch per revolution for drilling and 0.016 inch for ream-

Fig. 8. Squareness of the wrist-pin holes with the outside diameter and grooves of the piston is insured by means of a special hydraulic fixture and modified air gage on this precision boring machine

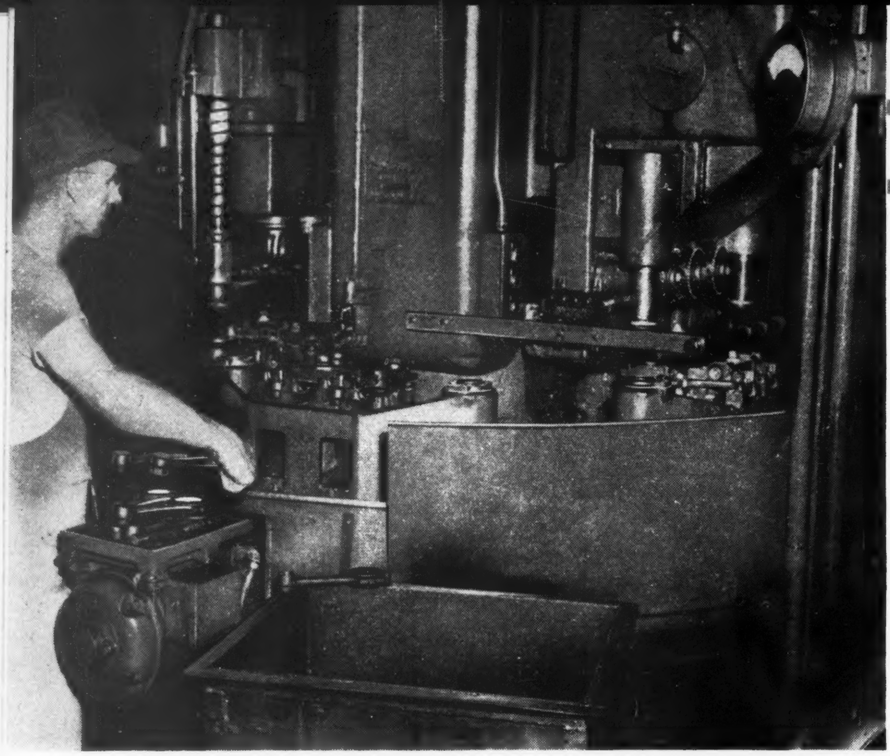


Fig. 9. Solid connecting-rod forgings are drilled, milled, and sawed apart at the rate of eighty-five per hour on a four-station indexing machine

ing. Hydraulically actuated, hinged bushing plates are provided at some of the stations which automatically swing outward to permit certain tools to reach the work.

As the cast-aluminum pistons designed for the high-compression engines have very little skirt, special means had to be devised for holding them during the machining operations. This problem was solved by drilling an accurately located hole in the end of each tapered projection at the skirt end of the piston, and one in a boss on the dome of the piston, so that the part could be held between centers during machining.

Wrist-pin holes must be held square with the outside diameter and grooves of the piston within 0.0005 inch. The precision finishing of these holes is accomplished on a Heald double-spindle boring machine, as seen in Fig. 8. A unique hydraulically actuated clamping fixture equipped with an air gage is provided on the machine to maintain squareness of the wrist-pin hole. The pistons are accurately located by pins that enter holes in the skirt or open end of the piston, and a center in the dome or head end.

The pistons are held securely during machining by hydraulically actuated hollow plungers that press down on the dome of the piston. A supply of compressed air, connected to a modified air gage, is introduced into the hollow plungers. If the piston is improperly seated in the fixture, causing leakage of air from between the mating surfaces of plunger and piston, an electrical interlock between the air gage and the machine will prevent the machine from operating. Chips or other foreign matter interfering with the squareness of the set-up can then be removed from the domes of the pistons before boring the wrist-pin holes.

Two pistons are bored at a time, giving a production of 100 per hour. Each spindle is equipped with two carbide tool bits for progressively roughing and finishing the holes. The spindles

Fig. 10. Wrist-pins having a uniform hardness of 62 Rockwell C, a ductile core, and an increase in fatigue strength are obtained by means of this induction heating set-up

are rotated at 1385 surface feet per minute and fed at 0.0025 inch per revolution. About 0.030 inch of stock is removed from the diameter of each hole by the roughing tools, and another 0.005 inch by the finishing tools. Hole size is maintained within 0.0005 inch.

Solid connecting-rods are forged from S A E 1035 steel. The rods are drilled, milled, and sawed apart on the Greenlee center-column, four-station indexing machine illustrated in Fig. 9. Forgings are loaded two at a time at the first station. A motor-actuated mechanical clamp is provided for applying a predetermined amount of torque to the work-holding fixture. The rotary indexing table carries the parts to the second station, at the left, where the 1-inch diameter wrist-pin hole is drilled and one-half of the 2 1/4-inch diameter crank-pin hole is core-drilled on both rods.

The other half of the elongated crank-pin hole is core-drilled and the wrist-pin hole is reamed at the third station, located at the rear of the machine. Simultaneously, bolt- and nut-seat pads and locating pads are milled. When the parts reach the fourth station, seen at the right, three slitting saws separate the caps from the connecting-rods. The saws are rotated at 70 surface feet per minute, the drills at 50 surface feet per minute, and reamers at 40 surface feet per minute. Both drills and reamers are fed at the rate of 0.032 inch per revolution, while the saws, which are 5 3/8 inches in diameter, are fed at 0.054 inch per revolution. A production of eighty-five rods and caps per hour is obtained.

Wrist-pins, made from S A E 1046 steel, are induction hardened with the high-production set-up shown in Fig. 10. A 20-K.W. Thermonic induction heater, made by the Induction Heating Corporation, is used. Pins placed in the automatic loading hopper drop through a chute onto a cam-controlled ram that lowers each pin through the induction heating coil and water-quench ring at the rate of 22 inches per minute. The lower end of the pin is being quenched while the upper end is still being heated. Approximately six seconds are required for heating, six seconds for quenching, and two more seconds for the ram to be raised and pick up the next pin.

A hardness of about 62 Rockwell C is obtained over the entire surface of the pin. Case depth is from 0.050 to 0.060 inch, the upper 0.020 inch being pure martensitic structure. After induction hardening, the pins are stress relieved by tempering at 250 degrees F. for three hours. Wrist-pins hardened in this way have a more uniform ductile core than those that are carburized, and the compressive stresses induced by induction hardening increase the fatigue strength.

Transfer Type Machines Produce Reo's "Gold Comet" Truck Engine

By A. W. ZIMMER, Works Manager
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Lansing, Mich.

Here is an Example of the Application of High-Production Equipment to Low-Production Requirements for the Purpose of Obtaining a More Accurate, Higher Quality Product at Lower Cost

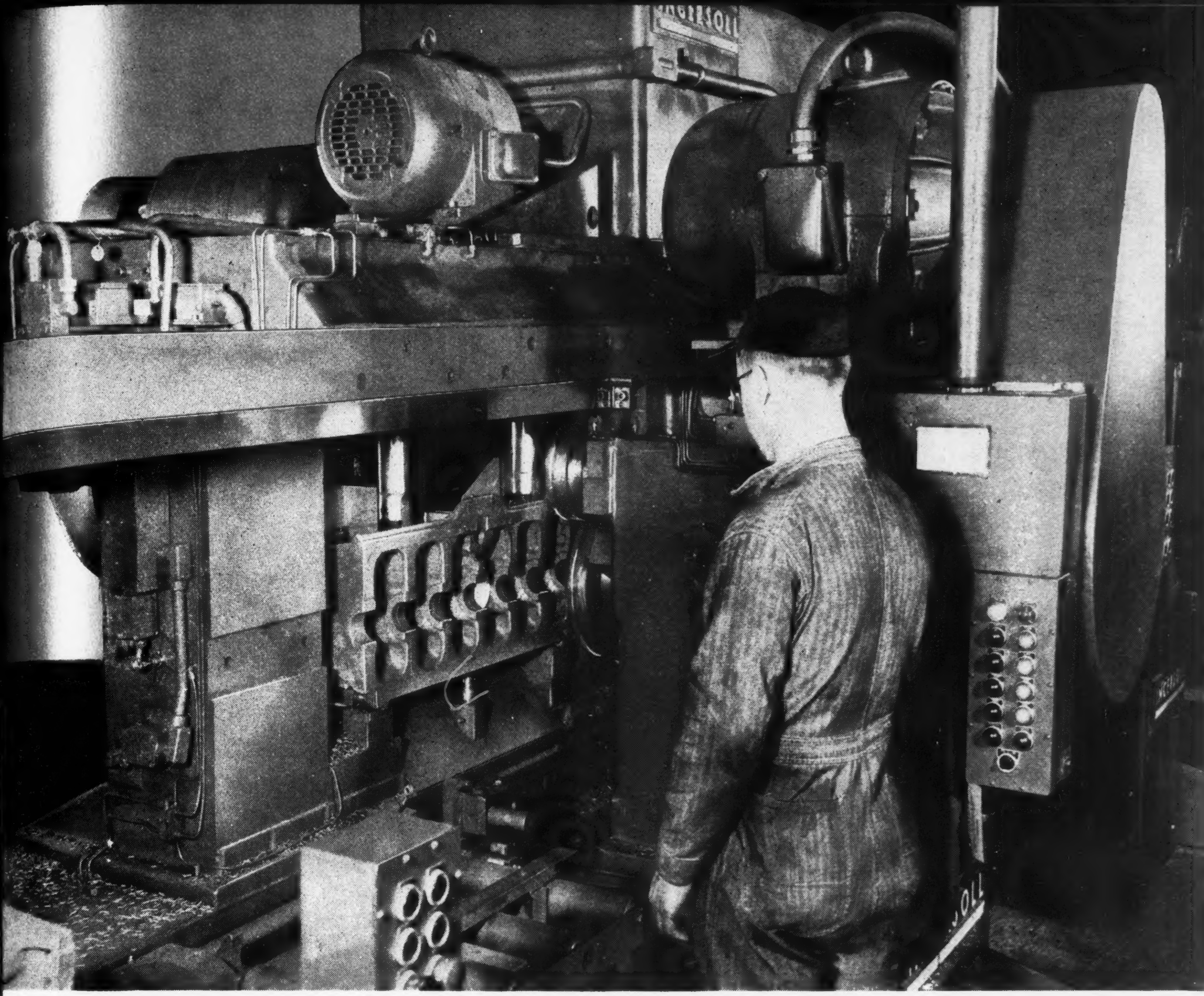
REO'S new engine plant contains $3,500,000 worth of the latest types of machine tools for producing the "Gold Comet" gasoline truck engine. Even though the present production of this engine does not exceed twenty per hour, transfer type and other machines generally found only in mass-production plants are employed to obtain a higher quality product at lower cost. The precision production methods and equipment used in this plant are described in the following.

The new "Gold Comet" engine is an overhead-valve, six-cylinder, gasoline truck engine employing the "wet sleeve" principle with replaceable cylinders. Other features of the engine include a seven-bearing crankshaft having induction-hardened journals and pins; an intake manifold cast integral with the cylinder head; and a gallery that directs water from the pump to the center of the crankcase block to provide improved cooling.

The eight-spindle, two-station Ingersoll milling machine seen in the heading illustration is used for machining the cast cylinder blocks. This shuttle type machine rough-mills the top surface of the block, rough- and finish-mills the oil-pan rail surface, and rough- and finish-mills the locating channel for the main bearing cap. The locating channel is finish-sized by means of a short broach, seen at the left in the rear view of the machine, Fig. 1.

An automatic loader positions the casting on its side in the machine, locating the block by means of four previously milled pads. The correct relative location between the top and bottom surfaces of the block is maintained by two accurately located bosses on the oil-pan rail. Hydraulically operated equalizing clamps and automatic jacks securely clamp the casting in the holding fixture. Micro-switches insure proper positioning and clamping of the part before the machining cycle begins.

After the casting has been fed past the five milling cutters at the first or roughing station, it is automatically unloaded and reloaded into a finishing fixture while the roughing fixture returns to the loading station to pick up another casting. At the same time that the new casting is being rough-milled, the previously milled cylinder block is carried past the three milling cut-



ters and broach at the second or finishing station, after which the completed part is automatically unloaded at the end of the machine.

Approximately 5/32 inch of stock is removed from the various surfaces of the casting, leaving 0.025 inch of stock on the top surface of the part for a subsequent finish-milling operation. In the operation just described, Shear-Clear type milling cutters with inserted carbide-tipped blades that are set at negative radial rake and positive axial rake angles are rotated at 250 surface feet per minute, and the work is fed past the cutters at the rate of 24 inches per minute. The broach consists of a series of high-speed steel inserted blades arranged in a herringbone pattern. Provision is made for automatically stopping the machine in case of cutter failure.

The over-all height of the cylinder block is maintained within $\pm$ 0.0025 inch, the width of the locating channel for the main bearing cap is held to $\pm$ 0.0005 inch, and the flatness of the pan rail surface is maintained within $\pm$ 0.001 inch. A production of twenty-seven blocks per hour can be obtained in this operation.

On the Cross Transfer-matic seen in Fig. 2, all the main and cam bearing holes in the cylinder block are rough-bored, the oil gallery hole is progressively drilled, and the stud and dowel holes in both ends of the block are drilled. This machine contains eight stations, including one idle, one loading, and one unloading station. Castings are automatically shuttled from station to station by a hydraulically actuated transfer mechanism. Four hydraulic, horizontal way type, multiple machining heads are employed for performing the series of operations. Three of the multiple heads each straddle two stations, and one head straddles three stations.

After being loaded at the first station, the part is automatically transferred to the second station, and raised hydraulically into the working position, being located by the pan rail and two dowel-holes. At this station, three of the main bearing holes are bored from one side of the

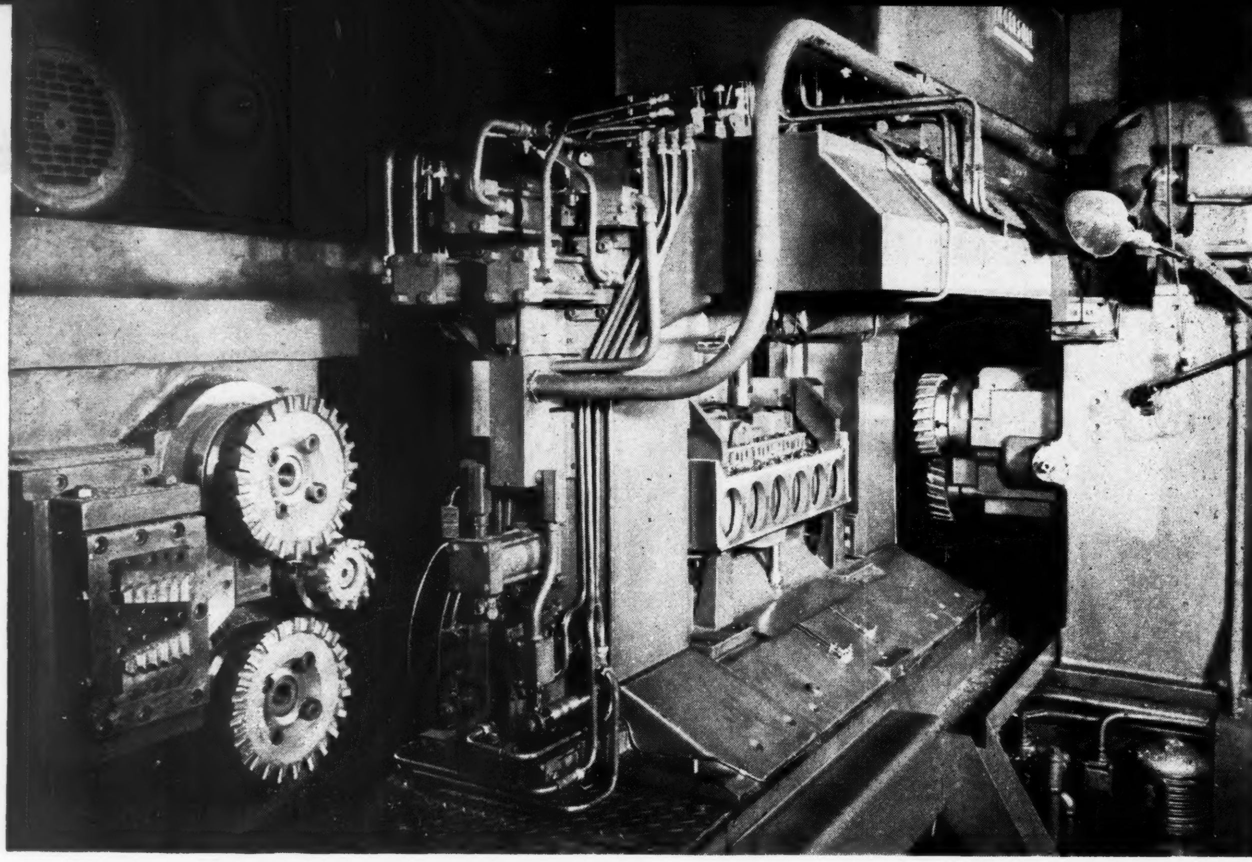
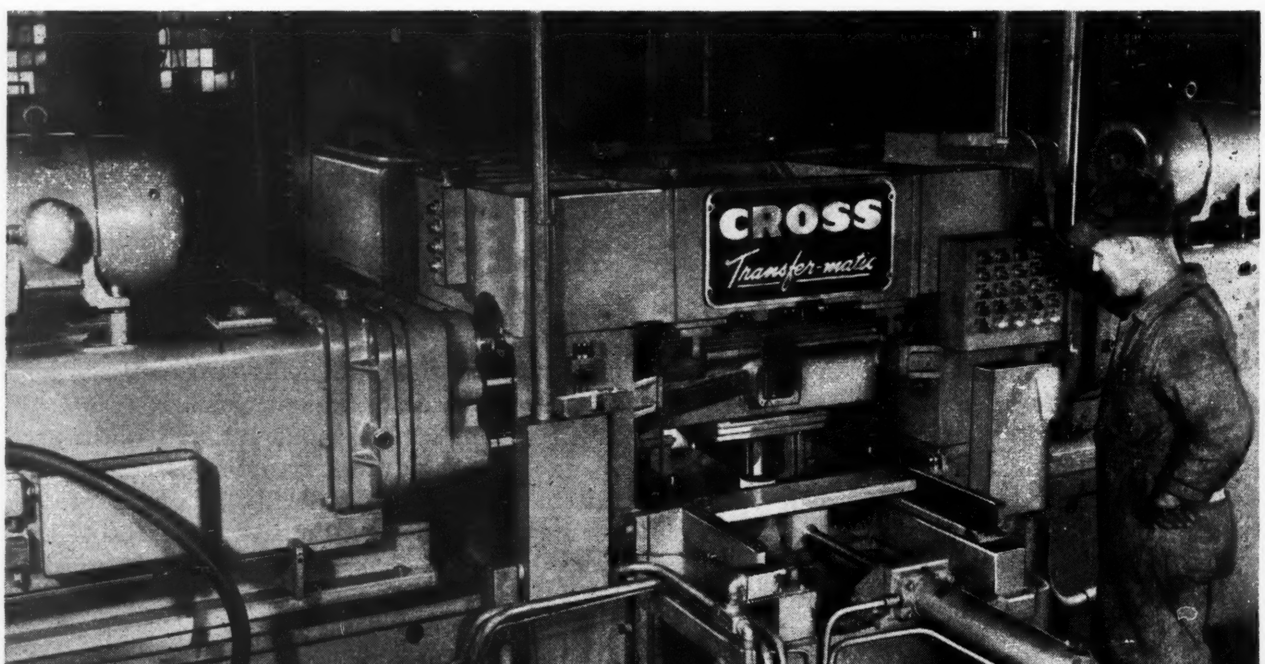


Fig. 1. Rear view of the eight-spindle, two-station shuttle type milling machine seen in the heading illustration. The broach at the left finish-sizes a locating channel for the main bearing cap

Fig. 2. All the main and cam bearing holes in the cylinder block are rough-bored, the oil gallery hole is progressively drilled, and the stud and dowel holes in both ends of the block are drilled on this eight-station transfer machine



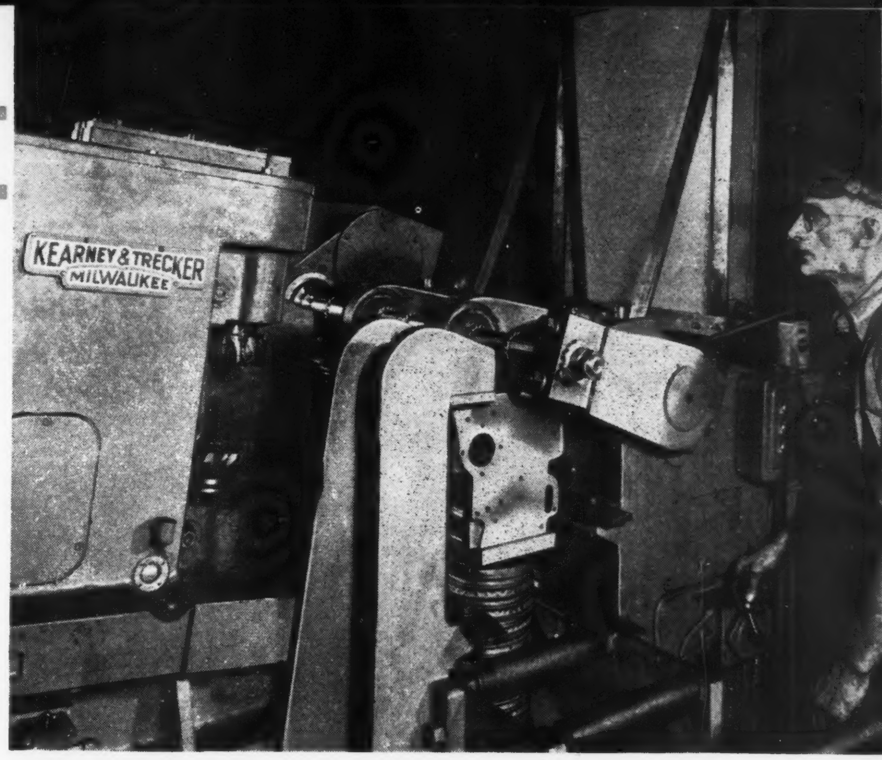


Fig. 3. A duplex head, seen at the left, mills mounting pads on the cylinder block, while a gang cutter set-up on the trunnion type milling unit at the right machines a lock notch in each of the main bearings

machine, and the remaining four from the opposite side. Long boring-bars, supported in rotary pilot bushings and containing a tool bit for each bearing, extend across the transfer table. The boring-bars need not be withdrawn, since the casting is raised into position between the boring tools.

At succeeding stations, the cam bearing holes are rough-bored, the oil gallery hole is progressively drilled to depth, and all the stud holes and two dowel-holes are drilled in each end of the cylinder block. Fifty-two spindles are employed on the four multiple heads to complete all the operations. With this set-up, a production of twenty-seven parts per hour is obtained. The carbide-tipped boring tools are held in removable block type holders. An automatic chip disposal unit is built into the machine to convey chips away from the various stations.

The special Kearney & Trecker milling machine illustrated in Fig. 3 is employed to mill the distributor and oil-pump mounting pads on the cylinder block and to mill the lock notch in each of the seven main bearing holes. The mounting pads are milled by the two carbide-tipped, inserted-blade shell end-mills seen on the duplex head at the left. This head is mounted on an angular slide equipped with hydraulic feed. The lock notches are milled by a gang-cutter set-up on the special trunnion type milling unit at the right.

The cylinder blocks are loaded manually on the fixture, and located, again, by the pan rail and two dowel-holes. The cutting cycle is automatic,

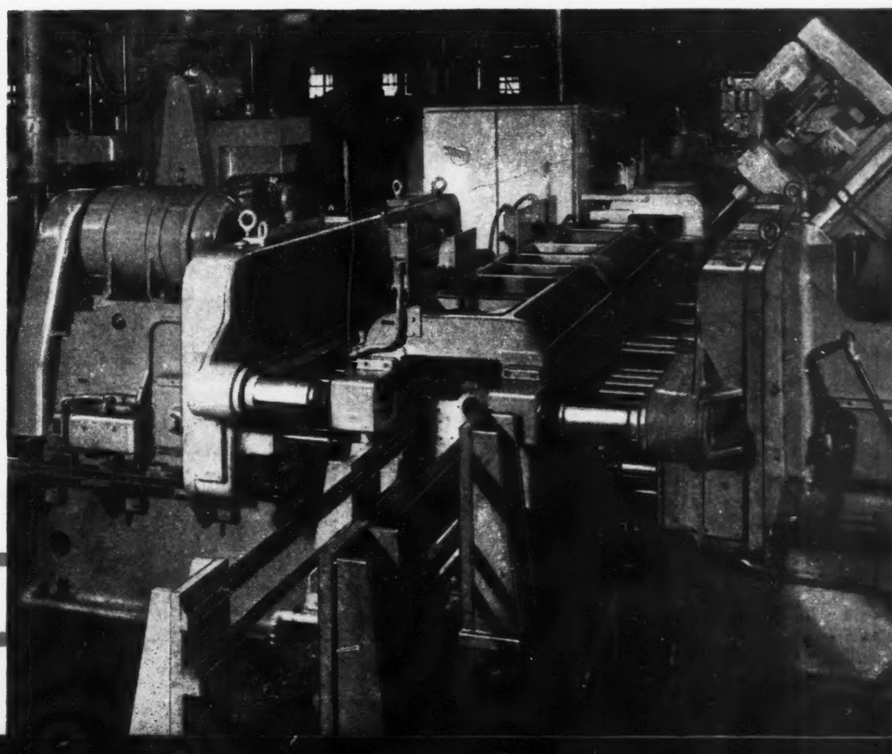


Fig. 4. This ten-station transfer machine is equipped with 147 spindles for finishing all holes in both the top and bottom of the cylinder block. The production rate is forty-five blocks per hour

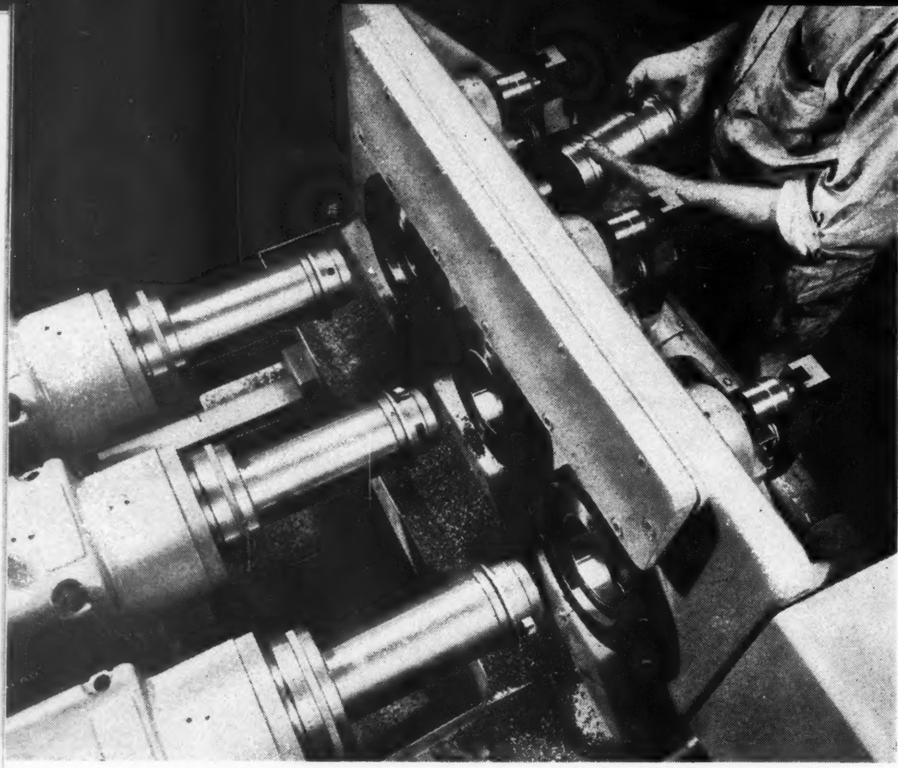


Fig. 5. Replaceable cylinder sleeves are finish-bored three at a time in this set-up. A tolerance of plus or minus 0.0005 inch is maintained on the bore diameter, and a production of fifty sleeves per hour is obtained

the duplex head feeding toward the casting as the trunnion unit swings down on the part. The speed of the cutters is 200 surface feet per minute, and the feed 15 inches per minute. About 3/16 inch of stock is removed from the mounting pads, and the lock notches are milled to 1/4 inch wide by 3/8 inch deep. A production of fifty cylinder blocks per hour can be obtained. The arbor carrying the notching cutters is so designed that it can be removed from the machine as a unit when the cutters become worn, and another pre-set assembly with sharpened cutters substituted, thus reducing machine "down time" to a minimum.

All holes required in both the top and bottom surfaces of the cylinder block are finished on a W. F. & John Barnes ten-station transfer machine. This machine is seen from the unloading end in Fig. 4. Handling is reduced to a minimum, and forty-five blocks can be completed per hour, only two operators being required. Holes drilled, chamfered, or counterbored on this machine include all the stud and bolt holes, tapped holes, connecting oil-holes, oil-pump and distributor-shaft holes, and water-passage holes.

On this machine, the castings are slid through the tunnel fixture on hardened and ground rails by a hydraulically operated transfer bar having projecting fingers that contact the blocks. Nine parts are shuttled simultaneously from station to station in each cycle. The blocks rest on their side, being located by means of four previously milled pads. At each station, except the two idle stations and the loading and unloading stations, the parts are hydraulically clamped against the oil-pan rail. They are further located by two pins that enter reamed holes in the block.

Multiple heads mounted on the six hydraulically fed, horizontal way type units along each side of the machine are equipped with a total of 147 spindles. All operations performed on the machine are controlled from a single panel at the loading station. Indicator lights are provided on the panel to show whether the tools at each station are functioning properly. High-speed steel drills and carbide-tipped core drills and chamfering tools are employed, rotating at 80 surface feet per minute. Chips are automatically conveyed through the base of the machine to an auxiliary conveyor at the rear that dumps them into a disposal truck.

Replaceable sleeves, which form the water-cooled cylinders when assembled in the cylinder block of the engine, are finish-bored three at a time on the Heald precision boring machine shown in Fig. 5. Since the alloy cast-iron sleeves are 7.750 inches long, over-size bearings are required to support the long boring spindles. A tolerance of $\pm$ 0.0005 inch is maintained on the bore diameter, and a production of fifty sleeves per hour is obtained on each of two machines.

The work-holding fixture is equipped with three pot chucks which locate the parts by the outside diameter and flange faces. Two hydraulically operated clamps contact the outer face of each flange to hold the sleeve securely in the fixture. No pressure is exerted on the periphery, thereby minimizing the possibility of

distortion. An exhaust manifold is automatically positioned in front of each sleeve during the machining cycle to prevent chips from accumulating between the spindles and the sleeve bores. Thus the cutter life is lengthened and improved surface finish obtained.

A single carbide-tipped tool bit, 5/8 inch square, is held in each spindle. About 0.015 inch of stock is removed from the bore diameter, the speed of the tools being 325 surface feet per minute and the feed 0.010 inch per revolution. Cylinder sleeves of three different bore sizes can be handled on the same machine by simply adjusting the tools in the spindles.

Ninety-two holes are drilled, reamed, or counterbored in each cylinder head on the Baush two-way, two-station horizontal drilling machine illustrated in Fig. 6. On previous engine models, two machines were required to complete these operations on the cylinder heads. The cast head is loaded manually into one of two identical fixtures, locating pins being engaged by a hand-lever and the part being secured by air-operated cam type clamps. An air-operated elevator, seen at the left, transfers the part to the upper station on the machine.

At the upper station, twelve push-rod holes are drilled to half the required depth and twelve valve-guide holes are drilled through from one side of the cylinder head. From the opposite side, twelve stud holes are drilled half way, three intake- and three exhaust-valve openings are counterbored, and two clean-out holes are core-drilled. When the casting has been transferred to the lower station, fourteen stud holes are drilled and twelve valve-spring washer seats are counterbored in one side of the head. On the opposite side, twelve push-rod holes are drilled half way to meet those previously drilled from the opposite side at the upper station, the two previously drilled clean-out holes are reamed, two more clean-out holes are core-drilled, and three intake and three exhaust valves are counterbored.

By drilling the stud and push-rod holes half way through from each side of the cylinder head, drill breakage and machining time are reduced. To offset any misalignment that might occur by drilling from both sides, the holes drilled in the top side of the head are made 1/32 inch larger in diameter. A production of thirty-five heads per hour is obtained. Three similar machines are employed to complete the numerous holes required on the top, bottom, and both sides of the heads.

In camshaft production set-ups, four machines were previously required to rough- and finish-turn the four bearing diameters, turn and face both sides of the gear blank, finish-face both ends of the shaft to length, and form and undercut the front end of the shaft for the timing gear. Now, all these operations are performed on one Seneca Falls "Lo-swing" automatic lathe, as seen in Fig. 7. The machine can produce sixty shafts per hour.

This automatic lathe is provided with a special center-drive mechanism containing a scroll chuck which locates the part on a specially ground di-

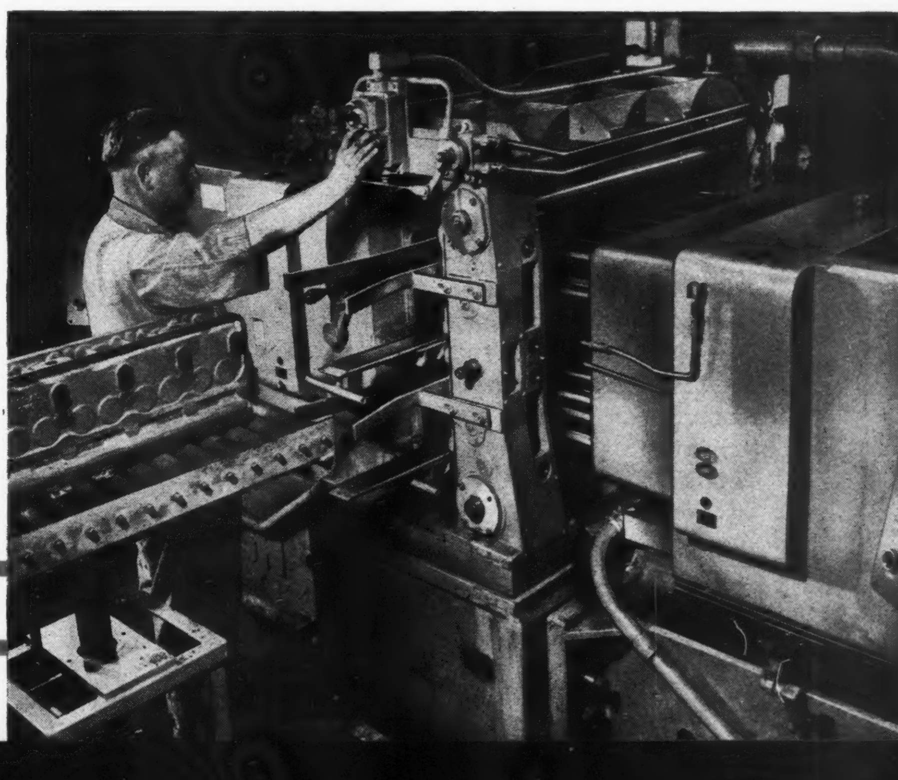


Fig. 6. Ninety-two holes are drilled, reamed, or counterbored in each cylinder head on this two-way, two-station machine. An air-operated elevator, seen at the left, transfers the parts from the upper to the lower station

Fig. 7. (Left) Operations that formerly required four different machines are now performed in this one set-up. The cast-iron cam-shaft is located between centers and rotated by a special center-drive mechanism

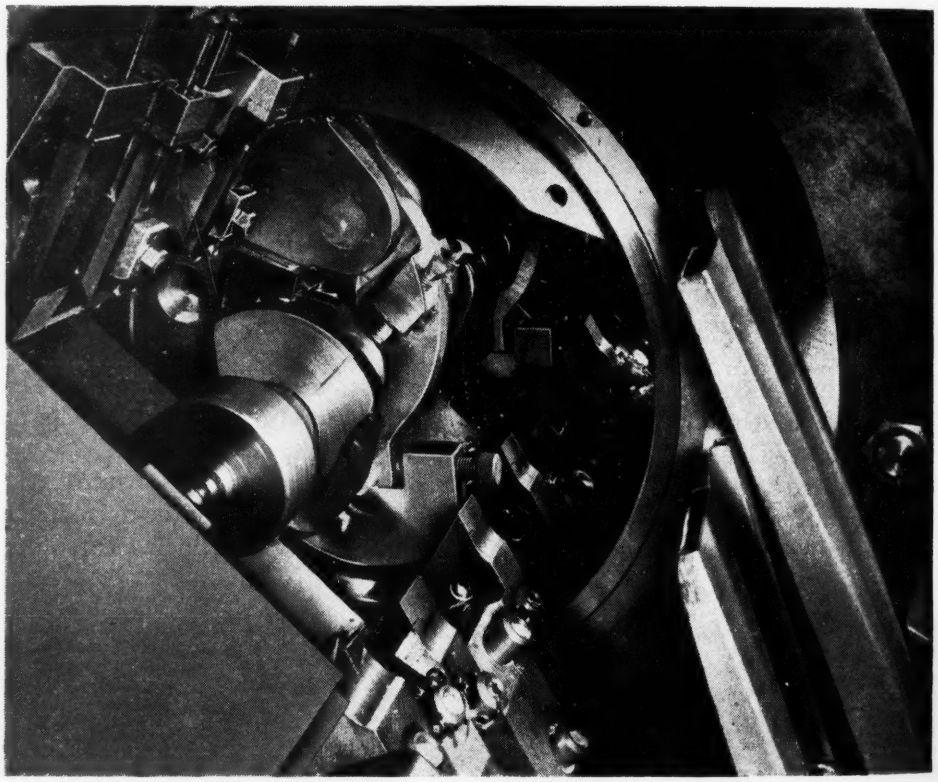


Fig. 8. (Right) Close-up view of the double center-driving arrangement and tooling employed on a crankshaft lathe for turning the seven main bearings and facing the adjoining cheeks at the rate of thirteen shafts an hour

ameter in the middle of the shaft. A driving dog is assembled on the cast-iron camshaft prior to loading it in the machine. An air-operated tail-stock facilitates loading. When the tailstock center is withdrawn from the work, the whole tailstock is automatically raised, so that the camshaft can be pulled out of the center-drive mechanism.

At the completion of the rough-turning operations on the bearing diameters, the front carriage and tool-block assembly are automatically advanced toward the work 0.010 inch, the direction of longitudinal feed is reversed, and a finishing cut is taken on each of these surfaces. The facing, forming, and under-cutting tools are carbide-tipped, while the turning tool bits are of the triangular solid-carbide type. Maximum run-out over the entire length of the shaft is main-

tained within ± 0.001 inch. Bearing diameters are held to within ± 0.0025 inch.

Main bearings on the forged S A E 1045 steel crankshafts are turned, adjoining cheeks are faced, the gear and pulley seats are formed and faced, and the flange end of the shaft is turned, faced, and chamfered on a LeBlond double center-drive automatic lathe (Fig. 8). Accurately located notches are milled on four of the cheeks for driving purposes. The shaft is loaded through the two center-drive units and nested in locating blocks that contact the Nos. 3 and 5 pin bearings. Hand-operated clamps hold the shaft securely in position between the centers.

A two-speed motor developing both 40 and 22 H.P. permits rotating the shaft at 42 R.P.M. while facing the cheeks, and at 56 R.P.M. while turning the bearing diameters. Feed rates automatically change from 0.045 inch per revolution during cheek facing to 0.012 inch as the tools near the bearings, and finally to 0.005 inch as the bearings are machined to size. Average stock removal is about 3/16 inch, and a production of thirteen crankshafts per hour is obtained on each of two machines. A copious supply of coolant, consisting of soluble oil in water, is directed on the high-speed steel tools from the rectangular ducts seen at the right.

Aluminum-alloy pistons are turned and grooved at the rate of 150 per hour on the double-end, four-spindle Ex-Cell-O machine shown in Fig. 9. The spindles are equipped with rotary air cylinders that actuate draw-bars. Dummy wrist-pins, which are fitted through the pin-holes in the pistons, are drawn back by these air-actuated bars, thus securely seating the pistons on adapters, which are located by accurately machined counterbores in the piston skirts.

Pistons on two of the spindles are machined while the other two are being unloaded and reloaded. The cross-slide is equipped with four sets of tool-holders, one set for each spindle. At the beginning of the cycle, the piston-ring lands are finish-turned and the skirt diameters are semi finish-turned before the skiving cuts are made in the ring grooves.

The tool-holders for each spindle are arranged in tandem, so that as the table is fed through its cycle, first the rough-skiving tools engage the grooves in the pistons, then the chamfering and turning tools, and finally the finish-skiving tools. At the completion of the skiving cut, the table is automatically traversed to the other two spindles, where the operation is repeated on two more pistons. The cycle is controlled by hydraulically operated cam-feed bars.

All the tools are carbide-tipped, and are fed at the rate of 0.0075 inch per revolution. Pistons 4.125 inches in diameter are rotated at 2100 R.P.M. To facilitate tool changes and minimize "down time," three sets of complete tool-block assemblies are provided, so that while one set is in use the other two sets are being reground and accurately reset preparatory to replacing worn assemblies. Supplementing the replaceable tool-block assemblies are five sets of various sized adapters, which enables five different piston sizes to be machined with simple tool changes.

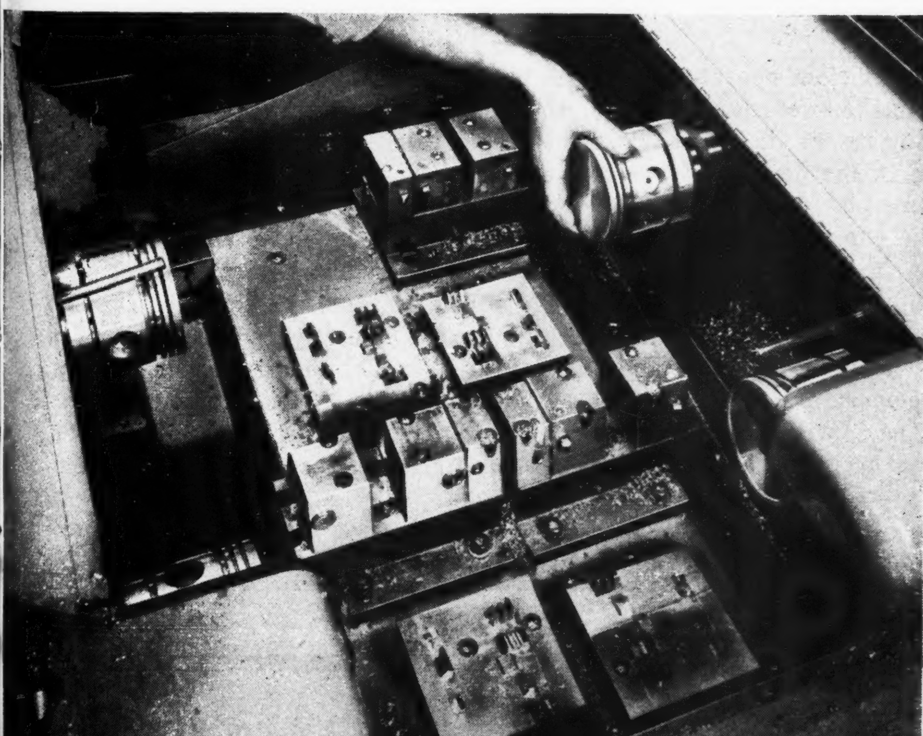


Fig. 9. Double-end, four-spindle machine for semi finish-turning the skirt, finish-turning the ring lands, and rough- and finish-skiving and chamfering the ring grooves of aluminum-alloy pistons

TO produce a low-priced, high-quality automobile with today's material and labor costs requires the ultimate in engineering ingenuity. Outstanding examples of the tooling developed by the Buick Motor Division, General Motors Corporation, Flint, Mich., for economically building the new Special Series 40 model car are described in this article.

Increased quietness and more efficient operating temperature are provided in the new engine by lowering the fan and reducing its speed. This change necessitated a revision in the design of the water pump. Although numerous machining operations are required on the complex water-pump body casting seen in Fig. 1, the parts are completely finished at the rate of ninety per hour on one machine. This Greenlee twelve-station transfer machine, shown in the heading illustration, requires only three operators. Previously, ten different machines, each with an individual operator, were required to produce 100 water pumps per hour.

To locate so complex a casting accurately and clamp it rigidly, a special work-holding fixture had to be designed. Each fixture, as shown in Fig. 2, holds two of the water-pump bodies. Specials pads are cast on the side of the body to facilitate locating and holding. A tilting targeting fixture is mounted on the side of the machine at the loading station, which has projections that enter the bearing holes and centralize the castings in the work-holding fixture. When the work has been properly located, it is clamped by an electric wrench.

The work-holding fixtures are transferred from station to station by means of a hydraulically actuated transfer bar having vertical projecting fingers that contact the fixtures. During the machining cycle, the fingers are withdrawn from the fixtures, and the transfer bar returns to its starting position. Guide rails keep the fixtures aligned, and hydraulic shot-pins enter bushings in the fixtures to accurately locate them at each station.

Cutting Machine Tools Boost Buick's Production

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Increasing Automotive Production, while Reducing Costs and Improving Quality, was Made Possible by Modern Machines and Tooling Methods, Outstanding Examples of which are Described Here

The work is loaded into the fixture at the first station, after which it is transferred to the second station, where four sub-land drills, mounted in a vertical head, drill and chamfer one heater hole and one transmission cooler hole in each water-pump body. The speed of the drills is 65 surface feet per minute, and the feed 3 1/2 inches per minute. Two horizontal heads are located at the same station to bore the clearance hole, rough-face the impeller clearance surface, and rough-face the cover of each casting. After being fed to depth axially, the facing tools are fed radially by a cam arrangement. The feed of the carbide-tipped, single-point boring and facing tools is 2 1/2 inches per minute. The heads are rotated at 177 R.P.M., corresponding to a surface speed of 200 feet per minute for boring, and at 150 and 225 feet per minute for the two facing operations.

At the third station, a carbide-tipped, multiple-diameter, two-bladed cutter is mounted on each horizontal head to bore the clearance hole, counterbore the seal hole, and rough-face the seal hub on each casting. For these operations, a tool speed of 340 R.P.M. and a feed of 4 inches per minute are employed. Angularly mounted drills at the same station are used when the old model of water-pump body is being run through the machine to fulfill service requirements. These drills and similar tools at subsequent stations are connected to a separate electrical system, and can be made inoperative by depressing a push-button.

Water-outlet bosses on the castings are milled at the fourth station, seen at the center of Fig. 3, by means of eight-bladed, carbide-tipped end-mills. As is the case with most other surfaces on the casting, approximately 3/32 inch of stock is removed. The tools are rotated at 350 surface feet per minute and fed at 14 inches per minute. The two heads seen in the right foreground are employed at the fifth station to finish-face the cover and the impeller clearance surfaces. Both carbide tool bits on each head are fed at the rate of 2 1/2 inches per minute, and the spindles are rotated at 177 R.P.M. On the opposite side of the fixture, seen at the left in the foreground, two carbide tool bits are mounted on each spindle to face and chamfer the bearing hole. The speed of these tools is 340 R.P.M., and the feed 2 inches per minute.

Station No. 6 is idle to provide space for two

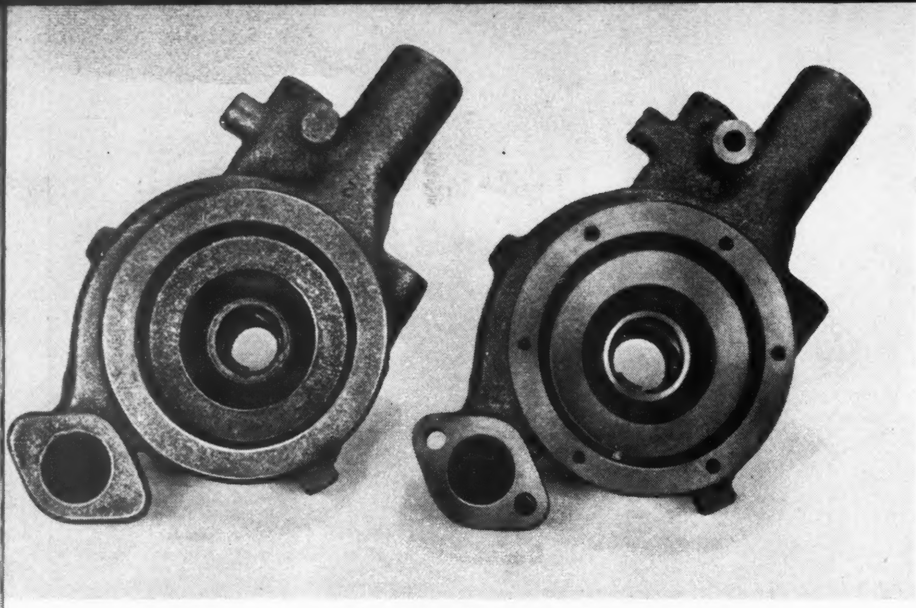


Fig. 1. Rough casting and finish-machined water-pump body. All the operations are performed on one transfer machine, seen in heading illustration

inspection fixtures that are used to check the machining operations performed up to this point. Two horizontal heads on one side of the seventh station are equipped with a two-bladed, carbide-tipped tool each for rough-boring the bearing hole in the castings. These tools have a speed of 125 surface feet per minute, and a feed of 4 inches per minute. Horizontal heads on the opposite side of the work-holding fixture contain clusters of drills for drilling six cover and two mounting holes in each water-pump body. The drills, 13/64 and 13/32 inch in diameter, are rotated at 65 surface feet per minute and fed at the rate of 4 inches per minute.

Station No. 8 is also idle, while at Station No. 9, the bearing hole in each water-pump body is grooved and recessed. Two round, solid carbide tool bits, 1/4 inch in diameter, are provided in each of the two spindles for these operations. The tools are rotated at 125 surface feet per minute and fed at 2 inches per minute. The bearing holes are finish-bored to a tolerance of 0.0005 inch, and the seal holes are finish-bored, chamfered, and faced by the tools provided at both sides of the tenth station. These single-point, carbide-tipped tools are also rotated at 125 surface feet per minute, but are fed at the rate of 4 inches per minute.

At the eleventh or final machining station, the six cover holes in each casting are threaded by 1/4-inch-20 taps, and two other holes are threaded by 3/8-inch-18 straight pipe taps. The feed of all taps is 18 inches per minute, while the speed of the smaller taps is 24 surface feet per minute, and of the larger ones, 57 surface feet per minute. This tapping station is the only one provided with a coolant. Mineral oil is automatically applied after each threading operation to flush chips from the taps.

After unloading the completed water-pump bodies at the twelfth station, the work-holding fixtures are returned to the front of the machine by means of a conveyor, seen at the right in the heading illustration. The conveyor carries the

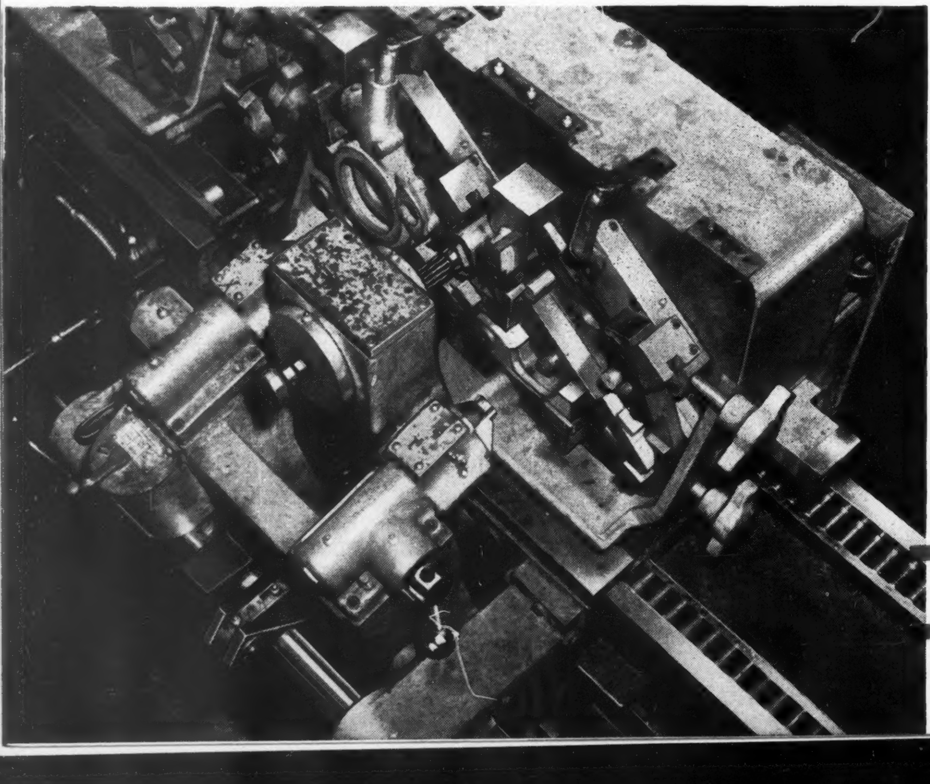


Fig. 2. Special fixture for accurately locating and rigidly clamping two of the complex-shaped water-pump bodies shown in Fig. 1

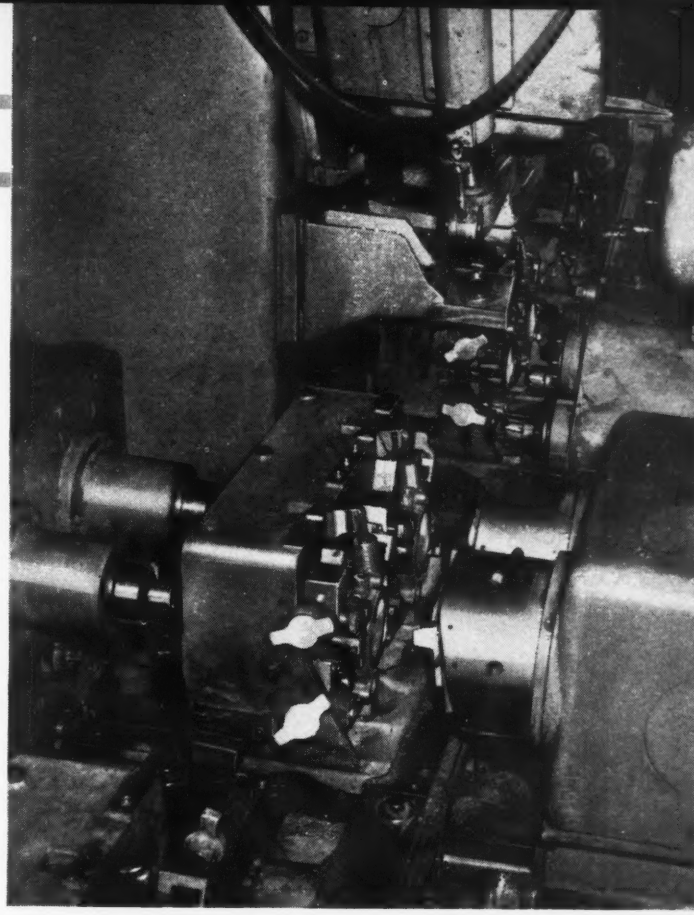


Fig. 3. Close-up view of the fifth station (foreground) and fourth station (center) on the transfer machine employed for completely finishing water-pump body castings

fixtures through an automatic washing machine to insure the removal of all chips and foreign matter from the locating and clamping surfaces.

Water-pump outlet elbows, which are also difficult castings to machine, are milled, drilled, and tapped in one operation on the W. F. & John Barnes special six-station indexing machine seen in Fig. 4. Faces of the two flanges, which are at right angles to each other, are milled square within 0.0015 inch, and two holes are drilled, countersunk, and tapped in each face. Rechucking of the casting has been eliminated by the use of this machine, and a production of 100 elbows per hour is obtained.

Locating pads are cast on the elbows to facilitate accurate location and rigid clamping. Each flange of the rough casting is located between two V-blocks, and a pivoted lever is employed for clamping. An electric wrench is provided on the machine for power actuation of the clamping mechanism. Large-diameter guide bars on the machining heads at each station enter bushings mounted around the center of the table to provide accurate location during machining.

After loading at the first station, shown in the foreground, the water-pump and crankcase faces of the elbow are milled at the second and third stations, seen at the left. Two holes, 0.4062 inch in diameter, are drilled and countersunk in the water-pump face at the fourth and fifth stations. Then these holes are tapped and two holes are drilled in the crankcase face of the elbow at the sixth station, seen at the right.. The inserted-blade, carbide-tipped milling cutters used on this machine are 4 inches in diameter and have six blades. They are operated at a speed of 250 surface feet per minute, with a feed of 0.064 inch per revolution.

Oil-pump gear blanks, made from S A E 1120 steel, are turned, faced on both sides, and chamfered at the rate of 190 per hour on the Heald double-spindle machine illustrated in Fig. 5. The

Fig. 4. Six-station rotary indexing machine for milling, drilling, and tapping both flanges of the water-pump outlet elbows in one operation

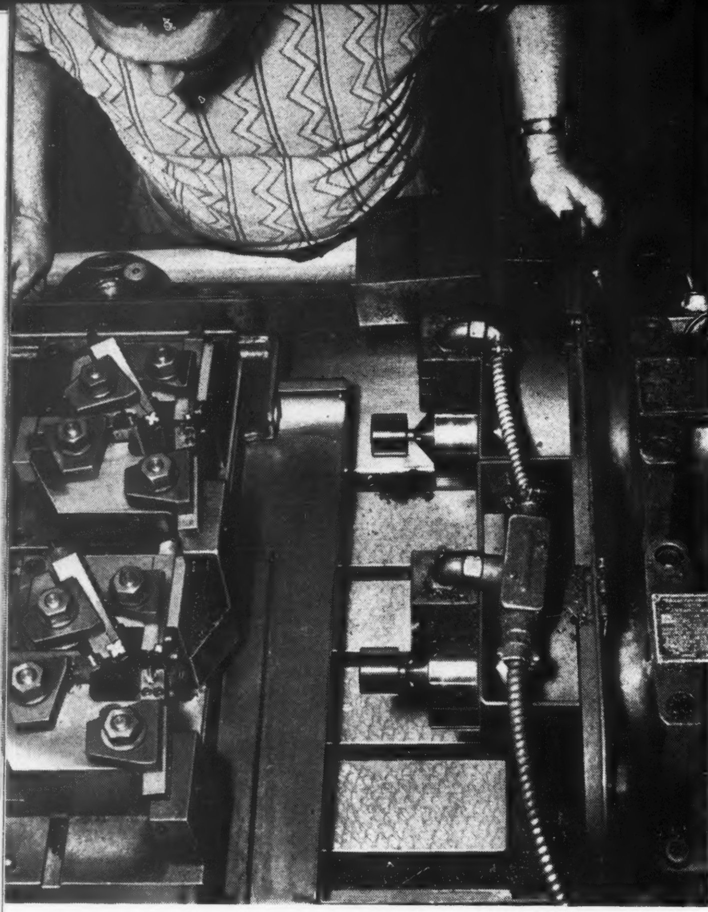


Fig. 5. Oil-pump gear blanks are turned, faced on both sides, and chamfered at the rate of 190 per hour on a double-spindle machine

sides of the blank are held parallel within 0.0005 inch, and a very smooth surface finish is obtained. Previous to this operation, the parts are turned, drilled, and cut off from bar stock on automatic screw machines, and the drilled hole in the bore of the blank is broached. Air-operated expanding arbors hold the parts by their accurately broached bores.

Four solid carbide tool bits are employed to machine each blank. A square tool bit, seen at the upper right-hand corner of each tool-holding block, first turns the blank. At the completion of the turning operation, the specially shaped, four-sided tool bits at the upper left-hand corners chamfer the blanks. The cross-slide then feeds toward the operator while the triangular-shaped bits in the lower right-hand corners face the back of the blanks. The tool-slide is then advanced toward the work and fed away from the operator while the square bits in the lower left-hand corners face the front of the blanks.

About 0.010 inch of stock is removed from each face and the outside diameter of the blank. The work is rotated at 643 surface feet per minute, and the tools are fed at 0.0133 inch per revolution.

Square, round, triangular, and special-shaped carbide tool bits are used for this and many other operations at Buick. A considerable increase in production has been effected by the use of such tools, since they can be rotated slightly in their holders when they become dull to present a sharp cutting edge to the work. Cutter life between sharpenings is thus lengthened, and machine "down time" for changing tools is reduced to a minimum. When the entire periphery has become dull, the tool can be turned upside down in its holder without affecting the set-up. As many as twelve sharp cutting edges can be employed on each round carbide tool bit before sharpening is required.

An ingenious automatic loading and unloading mechanism is provided on a battery of Fay auto-

Fig. 6. An automatic loading and unloading mechanism is provided on the lathe illustrated, which turns, chamfers, and faces valve-stem guides

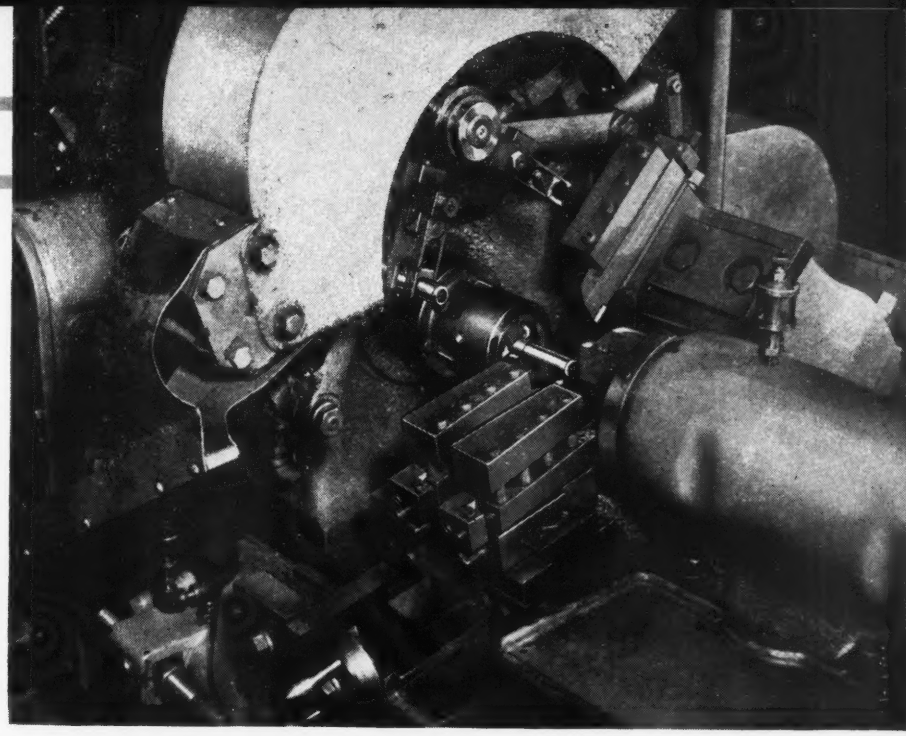


Fig. 7. Loading fingers return to the hopper for another part while the unloading fingers carry the finished part to a gravity chute

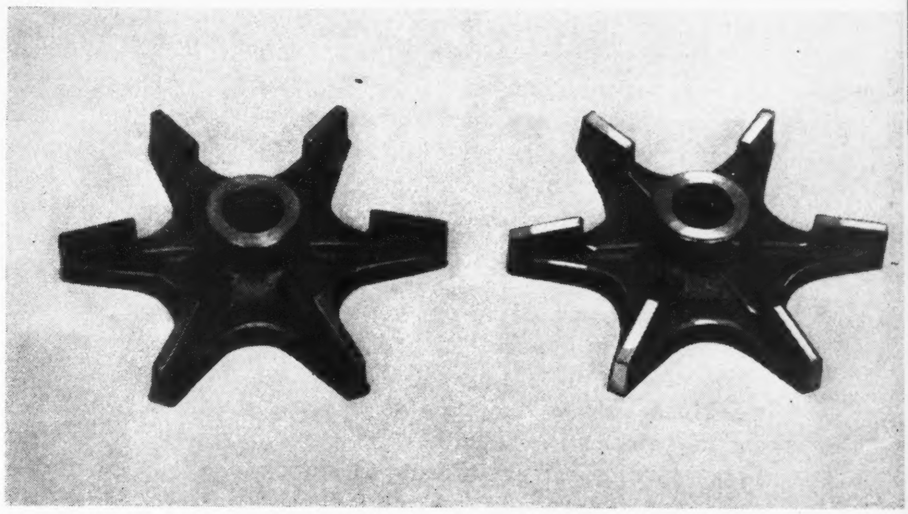


Fig. 8. Water-pump impeller before and after grinding the outside diameter and faces of the vanes on machine shown in Fig. 9

Fig. 9. Special double-spindle grinding machine for finishing the outside diameter and 15-degree angular faces of water-pump impellers

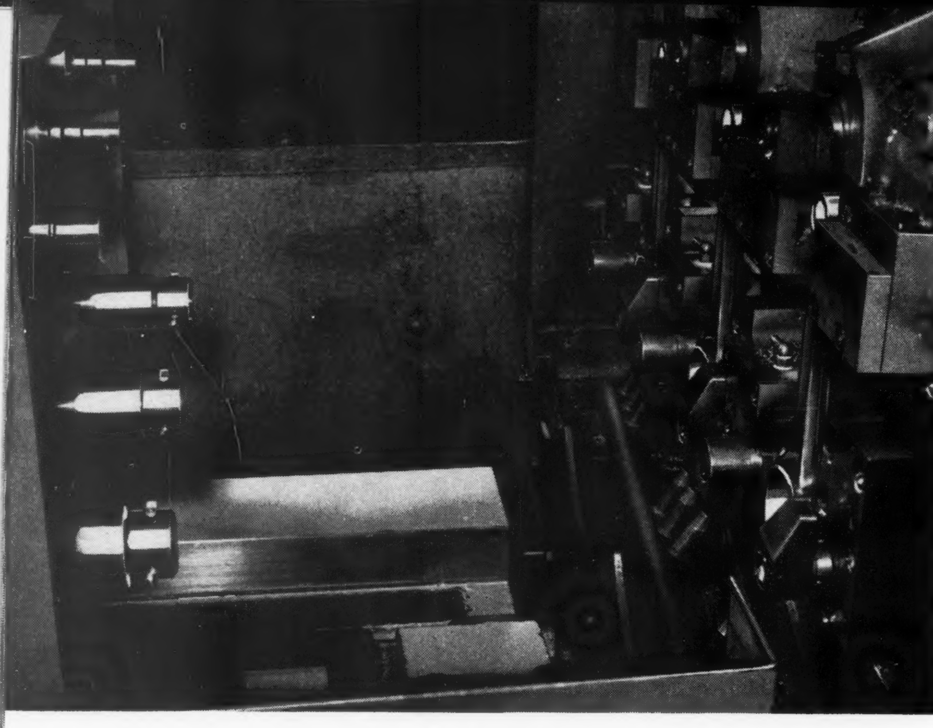


Fig. 10. Although both crank- and pin-holes of the connecting-rods are interrupted by slots and holes, precision boring to close tolerances is performed in the set-up illustrated

matic lathes for turning, chamfering, and facing valve-stem guides. The parts are loaded in a hopper, seen at the top in Fig. 6, from which they are picked up one at a time by cam-operated fingers. The fingers carry the guide to the machining position, where it is picked up by a cam-operated collet mounted on the spindle and a tailstock center. The tailstock and tailstock center are relieved to permit facing the end of the valve-stem guide.

The cam-operated levers return the loading fingers to the hopper for picking up the next part, while similar fingers transfer the finish-machined valve-stem guide to a gravity chute on the front of the machine (Fig. 7). Carbide-tipped turning and chamfering tools are mounted on the front of the machine, while the facing tool is pivoted about the rear bar by means of a cam. Approximately 3/32 inch of stock is removed from the face and outside diameter of the part. The work speed is 250 surface feet per minute, and the tool feed 0.024 inch per revolution. A production of 500 valve-stem guides per hour is obtained from each machine, with one operator attending two machines.

A special double-spindle Cincinnati grinding machine (Fig. 9) is employed for grinding the outside diameter and 15-degree angular faces of the water-pump impellers shown in Fig. 8. About 0.040 inch of stock is removed from each cast surface, and a production of ninety impellers per hour is obtained. The castings are mounted on the four pins seen projecting from the rotary indexing fixture in Fig. 9, and a C-washer and quick-acting nut are placed on the threaded end of each pin to hold the part in place.

When the casting is indexed to the grinding position, it automatically begins to rotate at 67 R.P.M. The 20-inch diameter grinding wheels, rotating at 114 R.P.M., simultaneously finish both the outside diameter and the faces of the vanes. A water-pump impeller is shown before grinding at the left and after grinding at the right in Fig. 8. The bore of the impeller is drilled and ground and the hub is faced previous to this operation.

Precision boring of connecting-rods is difficult because the crank-hole end has bearing-lock seats and an oil-hole in its bore, and the pin-hole end has a pinch-bolt slot and hole in its bore, which require interrupted cuts. However, by the use of the Ex-Cell-O six-spindle machine shown in Fig. 10, both ends of the rods are precision-bored at the rate of 112 rods per hour. Three rods are bored at a time in this semi-automatic operation, holding the crank-hole to a tolerance of 0.0005 inch and the pin-hole to 0.001 inch.

Push-button actuated hydraulic clamping means are provided to hold the rods, seen at the right. Carbide-tipped tools are mounted in the six spindles at the left, a single tool being held in each of the upper spindles and two tools—one for roughing and one for finishing—in each of the lower spindles. About 0.030 inch of stock is removed from the crank-hole diameter, 0.022 inch in roughing and 0.008 inch in finishing. Approximately 0.015 inch is cut from the pin-hole diameter with a single tool. The tools are rotated

Fig. 11. A two-spindle honing machine with a four-station rotary indexing table is used to finish the crank-holes in connecting-rods at a production rate of 225 rods per hour

at 375 surface feet per minute and fed at 0.032 inch per revolution. Tool life between sharpenings averages about 200 connecting-rods.

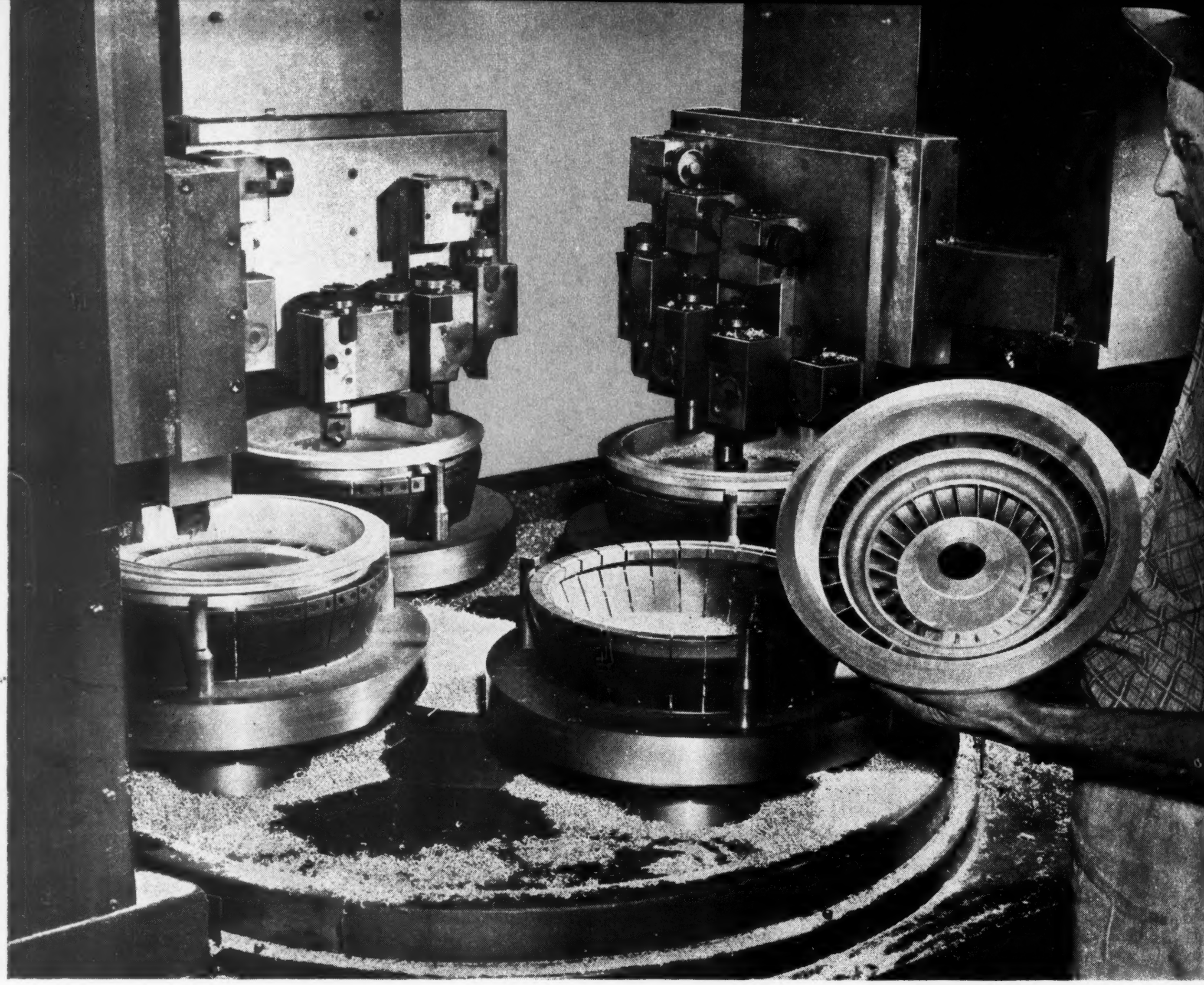
The pin-hole boring spindles are so arranged that they stop rotating with the tools directly over the pinch-bolt slots. In this way, the tools can be withdrawn without dragging over the bored surface, and a burring operation is eliminated. No further finishing is required on the pin-holes, but the crank-holes are subsequently honed.

Crank-holes in the connecting-rods are honed two at a time on the Micromatic honing machine illustrated in Fig. 11. About 0.0015 inch of stock is removed from the bores, holding the diameter within a 0.0003 inch limit and the taper to 0.0001 inch. A production of 225 rods per hour is obtained. The rods are not clamped during honing, but are merely located by pads and pins in the floating type fixtures. Thus each rod is free to align itself with the honing tool. Two rods are loaded on the rotary indexing table while two more are being honed.

Micromold tools, which are automatically expanded by hydraulic means, and a Microsize automatic sizing device are provided on the two spindles. Plastic tabs at each end of the tools wear with the abrasive. The outside diameter of these tabs is always equal to the diameter of the bore being honed. The upper tabs enter a gage ring, and when their diameter equals the minimum bore size desired, friction between the tabs and ring causes the ring to rotate slightly. This actuates a mechanism that prevents further expansion of the abrasive stones and automatically ends the honing cycle.

About twenty strokes of the rotating and reciprocating tools are required, the exact number varying with the amount of stock left in the bore after the previous boring operation. Sheffield Precisionaire gages, seen at the right of the illustration, are used to check the size and taper of the bores.

Aluminum-oxide vitrified-bond abrasive stones, of 180 grain size, are employed for this operation. The honing stones are set in plastic, and six stones are mounted on each spindle. Each set of stones lasts for about 800 connecting-rods. A sulphurized mineral-base oil, mixed with a kerosene base, is employed as the cutting fluid. The temperature of the cutting fluid is maintained at about 80 degrees F. A long conveyor is provided for carrying the honed rods to the final inspection department, so that they will have a chance to cool to room temperature before being inspected.



PACKARD'S Ultramatic drive is the latest development in automatic, no-shift control for automobiles. This drive combines a hydraulic torque converter with a planetary gear type of mechanical drive, the torque converter being used for smooth rapid acceleration and the mechanical drive for normal driving speeds. The clutch pedal is eliminated, and no shifting of gears is necessary. With this design, maximum engine efficiency is obtained during starting, acceleration, high speeds, and deceleration.

Automatic switching from torque converter to mechanical drive is accomplished by foot pressure on the accelerator, through hydraulic controls. If the pressure on the accelerator is light, the controls will automatically switch from torque converter to mechanical drive at fifteen miles per hour. If the pressure is heavy, the torque converter will remain in operation up to fifty-five miles per hour. Momentary release of pressure on the accelerator at any speed in this range will cause an immediate switch to the mechanical drive. The converter can again be brought into action for fast acceleration at any speed below fifty-five miles per hour by depressing the accelerator.

A cross-sectional view of the Ultramatic drive is seen in Fig. 1. The unit is 31 inches long and weighs 300 pounds. The torque converter, seen at the left, consists of four precision-cast aluminum vaned members, including the converter pump or driver *A*, first-stage turbine *B*, reactor *C*, and second-stage turbine *D*. Clutch *E*, when engaged by the hydraulic control mechanism, provides a direct driving connection between the flywheel and the input shaft *F* of the planetary transmission.

Two sun gears (driving gear *G* and low-range reaction gear *H*), three long planet gears *J*, and three short planet gears *K* are provided in the planetary transmission to obtain forward rotation. Sun gear *G* meshes with pinions *J*, which, in turn, mesh with pinions *K*. Pinions *K* also mesh with sun gear *H* and ring gear *L*. The

Packard's Ultramatic Drive Built by Precision Manufacturing Methods

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Extremely Smooth Surface Finishes, a High Degree of Flatness, and Close Tolerances are Required on Many Parts of the Ultramatic Drive. Manufacturing Processes Developed to Build these Precision Mechanisms Economically on a High-Production Basis are Described in This and a Subsequent Article

pinions are carried in cage *M*, which is an integral part of the transmission output shaft *N*.

When the plates of high-range clutch *O* are hydraulically compressed, sun gear *H* is locked to input shaft *F*, and the entire planetary system rotates at the same speed, with no gear reduction. A low-range band and lining *P* are provided to grip a drum and prevent the low-range reaction sun gear *H* from rotating during emergency low-speed operation. Reverse drum *Q* is formed integral with the planetary ring gear *L*. Reverse band and lining *R* are provided to grip the reverse drum and keep the planetary ring gear from rotating during reverse operation.

The planetary transmission is made fully automatic by means of a hydraulic control and operating system. Hydraulic pressure is used to engage the high-range clutch, to apply and release the low-range and reverse bands, to engage and disengage the converter direct-drive clutch, to lubricate all moving parts of the planetary transmission, and to keep the converter filled with oil under pressure. Control valve *S* is a manually controlled, distributing slide valve, operating in the machined, cast-aluminum valve body *T* and actuated by means of the shift selector lever on the steering wheel and linkage *U*.

Parts of the drive unit are subjected to pressures as high as 180 pounds per square inch and temperatures exceeding 275 degrees F. Very smooth surface finishes, a high degree of flatness, and close tolerances are required on many parts to withstand such service and provide a durable, efficient unit. Profilometer readings on certain hardened steel shafts cannot exceed 16 micro-inches r.m.s. Tolerances as close as $\pm$ 0.00015 inch are held on some parts. Processes developed and machines designed to build these ingenious drives economically on a high-production basis are described in this article.

All holes in the lower joint surface of the cast-iron transmission case are drilled, reamed, countersunk, and tapped on the special Footburt center-column machine seen in Fig. 2. Vertical unit type drilling or tapping heads containing 120 spindles are located around the center column

of the machine, and six work-holding fixtures are mounted on the rotary indexing table. The castings are loaded, bottom face up, at the first station, being located by previously milled and bored surfaces.

At the second station, twenty-four holes are drilled, and two holes are drilled and countersunk by means of sub-land drills. When the transmission case has been indexed to the third station, four more holes are drilled, another hole is drilled and countersunk, and two holes (0.5625 inch in diameter) are reamed. Sixteen holes are drilled at the fourth station, and thirty-four holes are countersunk at the fifth station. Taps, 5/16 inch in diameter with 18 NC 3 threads per inch, are mounted in Ziegler tap-holders at the sixth station to thread thirty-five holes.

The high-speed steel drills on this machine are rotated at 90 surface feet per minute and fed from 0.003 to 0.014 inch per revolution, depending upon the diameter of the drill. Reamers are rotated 65 feet per minute and fed at the rate of 0.004 to 0.020 inch per revolution. Taps are rotated at 18 feet per minute. A production of fifty transmission cases per hour is obtained in this operation.

A Sundstrand special four-head milling machine (Fig. 3) is employed to face two mounting pads, the speedometer-hole pad, and the governor-cover pad on the transmission case. Approximately 3/16 inch of stock is removed from each surface, using carbide-tipped milling cutters rotating at 380 surface feet per minute. The work, located on two pins in a hydraulically operated holding fixture, is automatically transferred to the two stations on the machine.

At the first station, seen in the background, the two mounting pads are faced by a pair of

Fig. 1. Cross-sectional view of Packard's Ultramatic drive. The torque converter is seen at the left, the planetary transmission at the center, and the hydraulic controls below the transmission

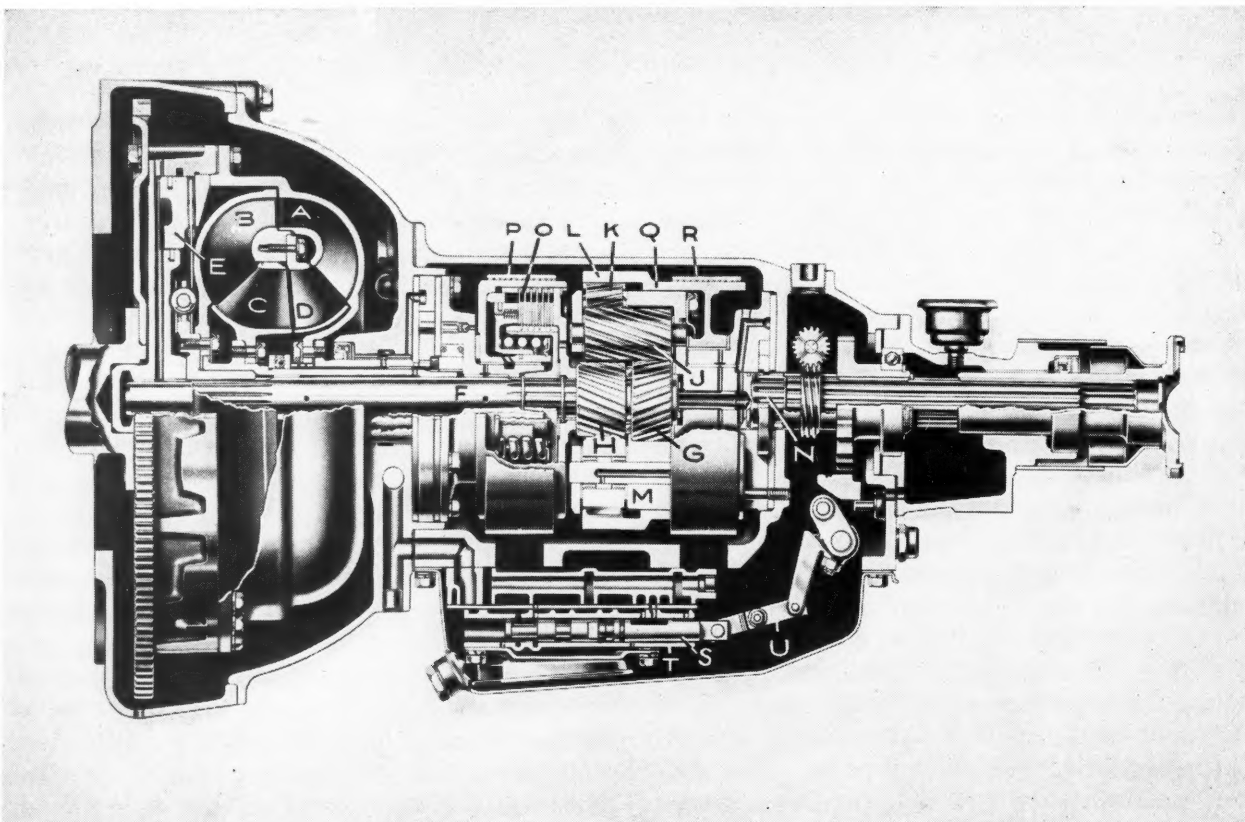


Fig. 2. Special six-station, center-column machine equipped with 120 spindles for drilling, reaming, countersinking, and tapping all holes in the lower joint faces of transmission cases

14-tooth face mills, each 6 inches in diameter. The cutters are automatically lowered past the work and raised at the rate of 22 inches per minute. The cast case is then indexed to the second station, seen in the foreground, where a 6-inch diameter face mill and a 2 3/4-inch end-mill (having eight teeth) are employed to mill the faces of the governor-cover pad and the speedometer-hole pad, respectively. The production rate on this machine is forty-eight castings per hour.

A Footburt eighteen-station transfer machine (Fig. 4) drills, counterbores, countersinks, spot-faces, reams, and taps holes on both sides of the transmission case. After the part has been loaded at the first station, being located by two pins in the work-holding fixture with the front face of the casting forward, the case is automatically transferred from station to station. A hydraulically actuated transfer bar with fingers projecting upward to contact the fixtures is employed. At the completion of the transfer stroke, the bar is rotated slightly, so that the fingers will clear the fixtures, and is then returned to its original position.

At the second station, six holes are drilled by tools in the right-hand head, and nine holes by tools in the left-hand head. One of the latter holes, 1.250 inches in diameter by 2.500 inches deep, is core-drilled. Tools on the two heads at the third station drill four holes, countersink four holes, and counterbore and spot-face two holes. At the fourth station, a hole on the left side is drilled, and a hole on the right side is counterbored and countersunk. Another ten holes are drilled, countersunk, or spot-faced at the fifth station. At the sixth station, an angular head is provided to drill one hole, while eight more holes are reamed or countersunk by tools on the right- and a left-hand heads.

Stations No. 7 and 8 are idle. A through hole, 1.094 inches in diameter, is core-drilled by means of an angular head at the ninth station. Mounted on the right-hand head at this station is a combination core-drill and counterbore. Two-step reamers are employed at the next station to simultaneously ream and countersink holes. Station No. 11 is idle, and at subsequent stations the previously drilled holes are reamed and tapped. A total of 107 tools is employed on this huge machine. The surface speeds (in feet per minute) of the tools are: 90 for the drills and counterbores, 65 for reamers, and from 15 to 22 for taps. Feed rates range from 0.003 to 0.020 inch per revolution, being based on a feed of 0.010 inch per revolution for 9/16-inch diameter

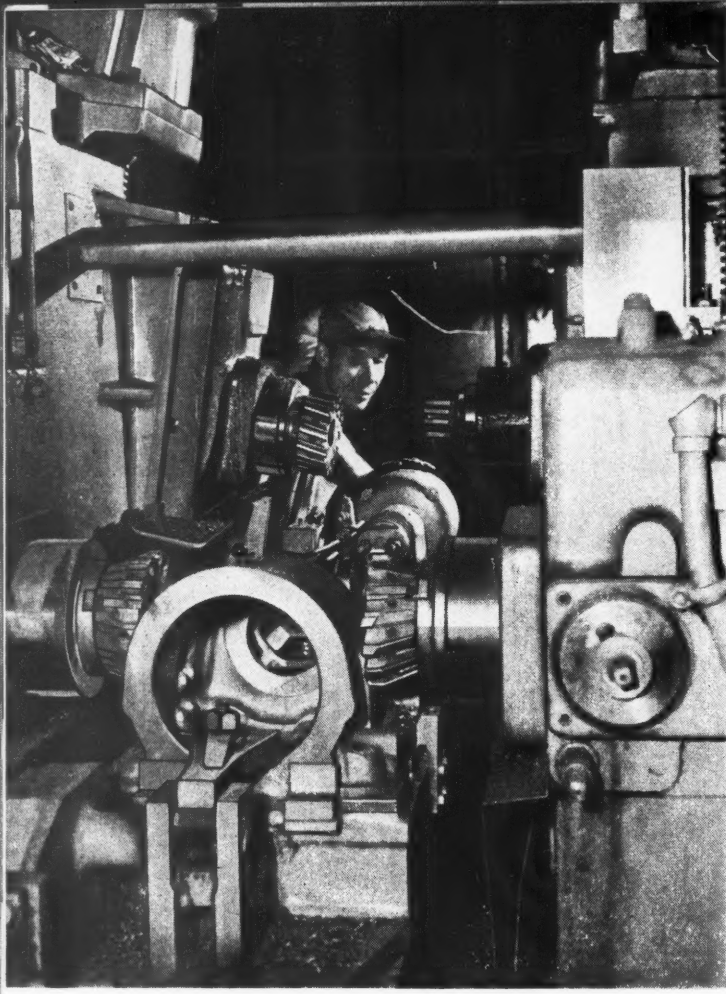


Fig. 3. Two mounting pads, the speedometer-hole pad, and the governor-cover pad on the transmission case are face-milled in one set-up on a four-head milling machine

tools. The production on this machine is fifty cases per hour.

Following the operations just described, a special Packard-built fixture is employed to spot-face accurately three internal bosses. Holes in the front, rear, and inside of the transmission case are then drilled, reamed, chamfered, and tapped on a Footburt fourteen-station transfer machine. The operation, speeds, feeds, and production of this machine are the same as on the eighteen-station machine. At the end of the operations on this machine, the parts are automatically conveyed through an alkaline washing machine. After subsequent operations, including precision-boring, finish-facing, finish-milling of the oil-pan and valve-body seats, deburring, washing, and inspection, the transmission cases are ready for assembly into the Ultramatic drive unit.

Bell housings for these units are turned, bored, faced, and chamfered on Bullard six-spindle Mult-Au-Matics. Each cast-iron housing is then loaded on a plate fixture and fed into the Greenlee twenty-two-station automatic transfer machine illustrated in Fig. 5, for drilling, spot-facing, countersinking, chamfering, reaming, and tapping all holes. The housings are loaded on the fixtures bell end down, being located from the semi-finished pilot holes and radial bosses. Pneumatic nut-runners are employed to clamp the flange face of the housing against the plate fixture. The work-holding fixtures are automatically transferred from station to station by means of hydraulic transfer bars and fingers.

An unusual feature of this machine is that the housings (and fixtures on which they are mounted) are automatically tilted to an angle of 90 degrees at the eighth and ninth stations,

Fig. 4. A production of fifty transmission cases per hour is obtained on this eighteen-station transfer machine. Both sides of the case are drilled, reamed, and tapped

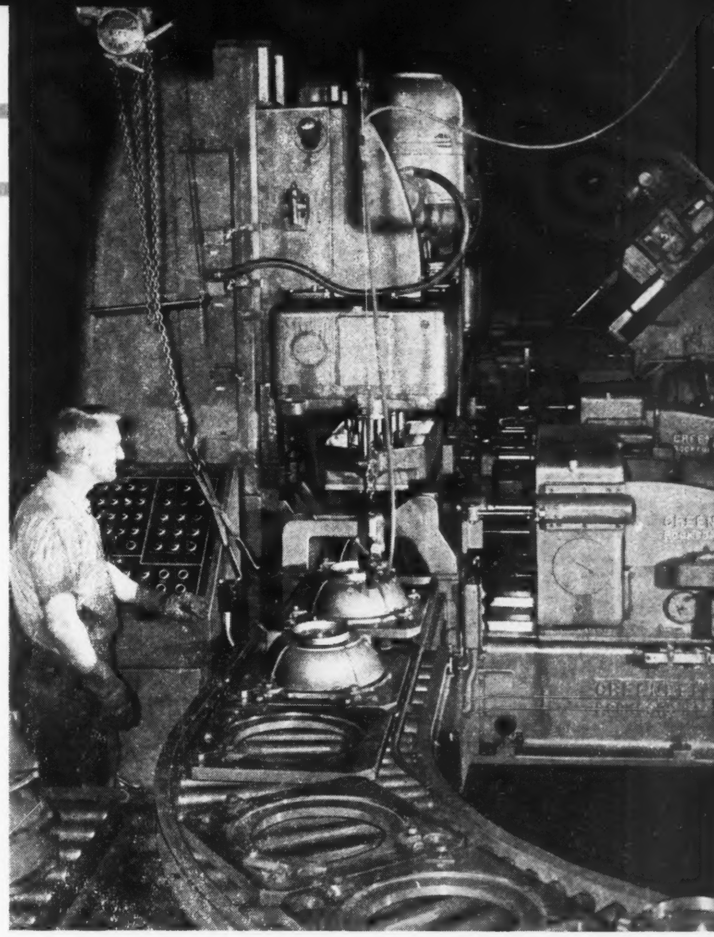


Fig. 5. All holes in the bell housings for the Ultramatic drive units are machined on the twenty-two-station automatic transfer machine here illustrated

as seen in the background of Fig. 6. This facilitates the drilling of holes on the inside of the work. At the eleventh station, seen in the foreground, the work and fixture are automatically rotated 90 degrees counter-clockwise for machining at the subsequent stations. The fixture and completed part are cleaned by automatically passing through an alkaline washer located at the end of the machine.

More than one hundred tools are mounted on the horizontal, vertical, and angular heads of this 47-foot long transfer machine. Drills are rotated at 90 feet per minute, reamers at 65 feet per minute, and taps at 18 feet per minute. Feed rates vary from 0.004 to 0.022 inch per revolution, being based, in this case also, on a feed of 0.010 inch per revolution for a 9/16-inch diameter drill. The cycle time of seventy-two seconds per housing (resulting in a production of fifty castings per hour) is divided as follows: 8 seconds for transferring, clamping, and unclamping; 2.5 seconds for rapid approach of the tools at a rate of 190 inches per minute; 56.6 seconds for the maximum feeding stroke of 4 1/4 inches; 1 second dwell; and 3.9 seconds for rapid return of the tools.

A unique method is employed in producing brake bands for the Ultramatic drive unit. Instead of hogging out a thick-walled, forged ring to form the necessary lug on the band, the lugs are made separately and brazed to the bands. This method results in high production at a relatively low unit cost. The bands, 6 7/8 inches in diameter by 2 inches wide, are turned, bored, and cut off from tubing on Sundstrand stub lathes.

The lugs are produced from seamless steel tubing, 7.690 inches in diameter with a wall 0.524 inch thick. The tubing is turned, bored and cut-off in 2-inch lengths on Potter & Johnston automatic turret lathes. The outer surfaces of the rings thus produced are broached to form five lugs on the Oilgear 15-ton vertical broaching machine shown in Fig. 7. Five passes of the broach are made, the work being indexed between each pass. The depth of the formed cut varies from 0.050 inch to 1/4 inch. The broach, which is 48 inches long, is fed hydraulically through the 54-inch stroke at the rate of 19 feet per minute. Eighteen formed rings are turned out per hour, which results in a production of ninety lugs per hour when the rings are subsequently sawed apart.

One lug is attached to each brake band by means of two screws, and the assemblies are passed through a hydrogen brazing furnace to braze the lugs to the brake bands. One side of the brake band and lug assembly is surface-ground, and the strut sockets in the lugs are form-broached. Formed Raybestos brake lining is inserted in the brake-band assembly after one side of the lining has been coated uniformly with "Cycle-weld" bonding cement, 0.003 to 0.005 inch thick. A hydraulically operated, internal expanding vulcanizing fixture applies heat and pressure to bond the lining to the brake band.

The Raybestos brake lining is now rough- and finish-bored, grooved, and faced on the New Britain double-spindle precision boring machine seen in Fig. 8. Two brake-band assemblies are machined at a time, resulting in a production of 109 per hour. Diamond-pointed boring tools are used, while the grooving and facing tools consist

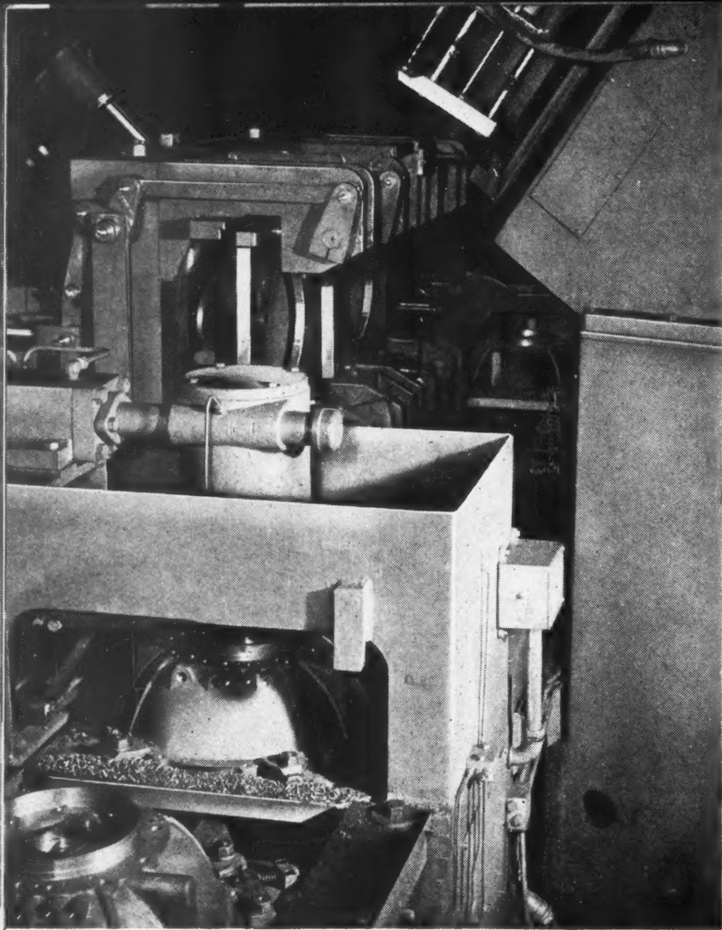


Fig. 6. At the eighth and ninth stations of the transfer machine seen in Fig. 5, the housings are automatically tilted to facilitate drilling holes inside the parts

of a series of tungsten-carbide tipped tools inserted in a holder. The work speed is 350 surface feet per minute, while the tool feed is 0.015 inch per revolution for boring and 0.002 inch per revolution for grooving. Special dust guards and dust collectors are used to protect moving members of the machine from the fine, highly abrasive material cut from the lining.

Components of the torque converter are thin-walled aluminum-alloy Alcoa 319 castings having integral vanes. These parts are cast to relatively close tolerances by an Alcoa plaster sand casting process, in which plaster cores are employed to form the oil passages between the vanes. The castings are heat-treated to a Brinell hardness of 85 prior to machining.

A Hoern & Dilts four-station, precision contour boring machine, shown in the heading illustration, is employed to rough- and finish-turn, bore, face, form, and chamfer the torque-converter pump. The casting is chucked on a previously turned diameter, resting on the finish-faced under side of the flange. A special diaphragm chuck, operated by a foot-actuated air cylinder, is provided at each station on the rotary indexing table. Micrometer-adjusted tool-holders equipped with single-point carbide tools are mounted on the cam-operated tool-slides at each of the three machining stations.

After the converter pump is loaded at the first station, it is indexed to the second station, seen at the left. Here a single boring tool is automatically guided through a predetermined path by a combination of the cam-actuated cross and down feeds to generate the angular and contour surfaces on the inner ring of the casting. Four tool bits are provided at the third station to rough-turn the pilot diameter, face the flange, pilot end, and inner hub, and bore two diameters.

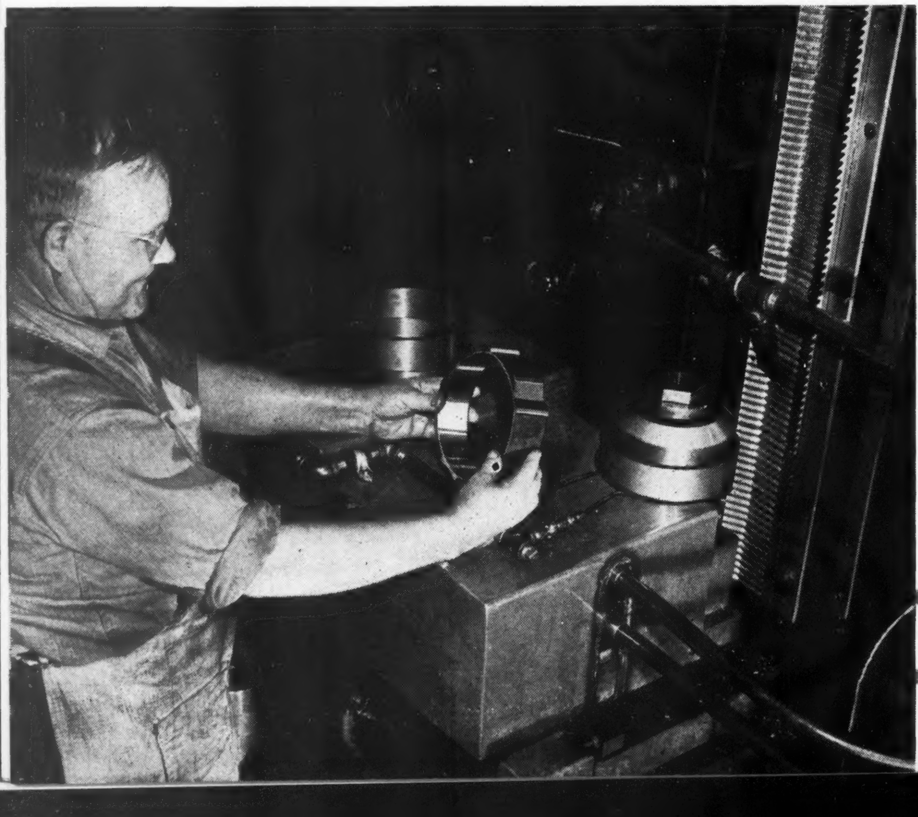


Fig. 7. Five brake-band lugs are obtained from a single steel ring by broaching the ring with the equipment here illustrated, and then sawing it apart

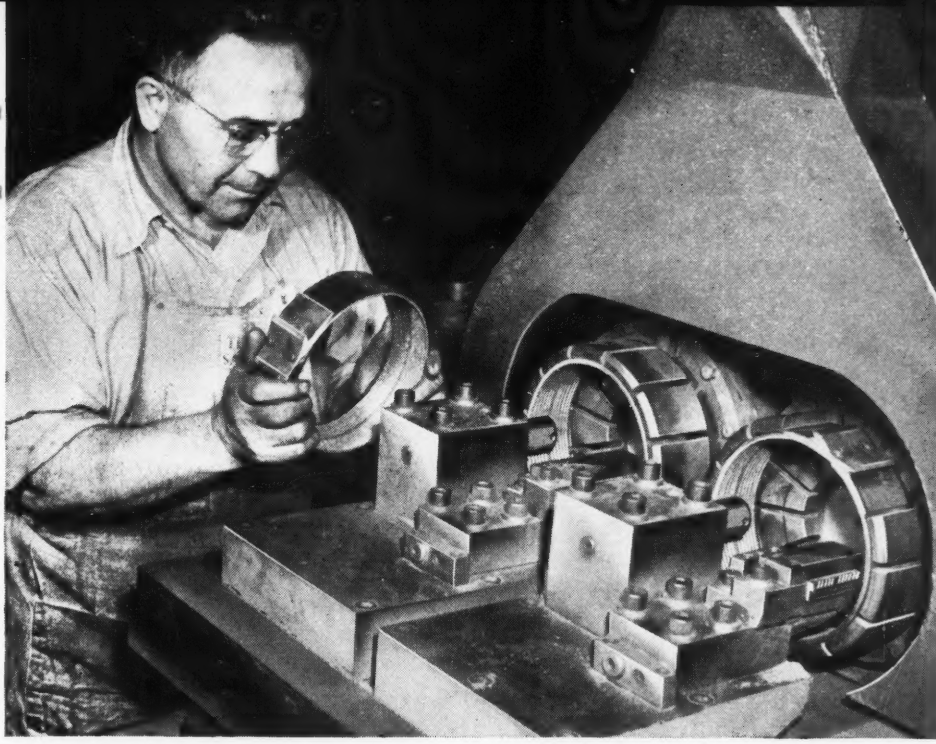


Fig. 8. The brake lining, after being "Cycle-welded" to the bores of the brake band and lug assemblies, is rough- and finish-bored, grooved, and faced in this set-up

At the fourth station, four more tools are employed to finish-turn, chamfer, bore, face, and counterbore various surfaces.

Approximately 0.015 inch of stock is removed from each surface in these operations. The work is rotated at 600 R.P.M., giving a surface speed of 2000 feet per minute on the outside diameter of the part. The tool feed is 0.006 inch per revolution. A tolerance of $\pm$ 0.0005 inch is maintained on the 3.1250-inch dimension of the pump. The production in this operation averages sixty castings per hour. The converter pumps are subsequently blasted with ground walnut shells to remove burrs formed during machining and improve the surface finish.

Transmission inner brake pistons, made from S A E 1017 steel that has been carbo-nitrided to file hardness, are ground internally by means of the automatic set-up seen in Fig. 9. A Bryant cam-operated internal grinder is used for this operation. The machine is equipped with an automatic, cam-actuated loading and unloading device and a high-frequency wheel-head. The 5/8-inch diameter grinding wheel is rotated at 35,000 R.P.M., giving a surface speed of about 5720 feet per minute. The blind hole in the piston is 0.6406 inch in diameter by 1 1/2 inches deep. Hole size is maintained within $\pm$ 0.0005 inch, and a surface finish of 20 micro - inches r.m.s. is obtained. The production rate is 180 pistons per hour.

The pistons to be ground are loaded manually in the top of a gravity chute. Spring type fingers, mounted on the end of a cam-actuated, swiveling loading arm, automatically pick up a piston from the bottom of the chute and place it in the collet

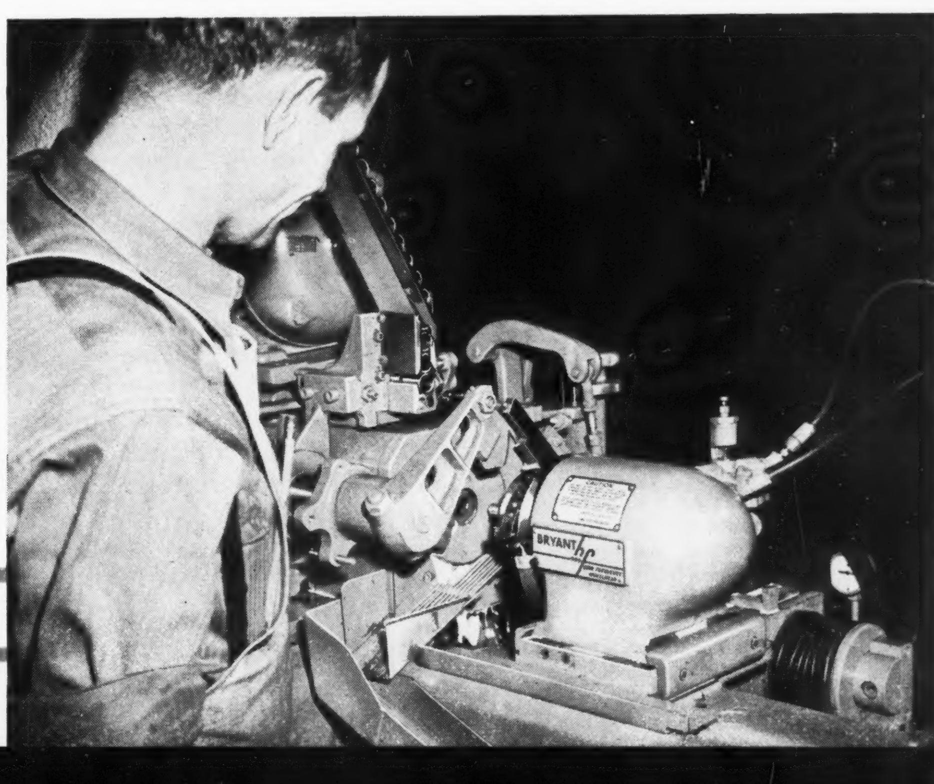


Fig. 9. A blind hole is ground in transmission inner brake piston on a machine having an automatic loading and unloading device

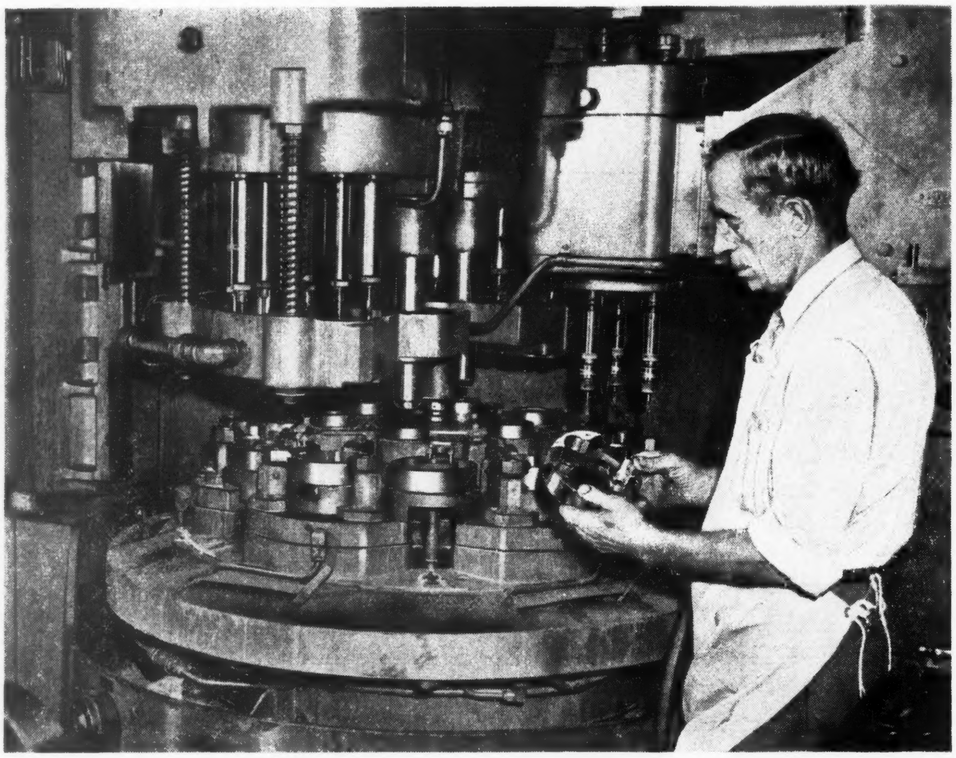


Fig. 10. Holes in the front planetary cage of transmission are drilled, countersunk, reamed, and tapped, and pinion pockets are counterbored, on a six-station double-indexing machine

type chuck of the grinder. A cam-actuated draw-bar closes the chuck, and the loading fingers are withdrawn and swung out of the way to permit the grinding wheel to enter the work for rough-grinding. At the completion of the rough-grinding operation, the wheel is automatically withdrawn from the work, is dressed, and then re-enters the work for finish-grinding. When the wheel is again withdrawn, the completed part is automatically ejected from the machine, and the cycle is repeated. The entire cycle requires only twenty seconds.

From 0.008 to 0.010 inch of stock is removed from the bore diameter in rough-grinding, and about 0.0005 inch in finish-grinding. The work is rotated at 1200 R.P.M. An 80-grit, vitrified-bond, aluminum-oxide wheel, 1 inch long, is employed. Ample coolant is directed into the work to reach the blind end of the hole.

A Cross six-station, double-indexing machine (Fig. 10) is employed to drill, countersink, ream, and tap twelve holes, and counterbore six pinion pockets in the front planetary cage of the transmission. Each part goes through the machine twice, the position of the part being reversed in the fixture after the first pass. A production of sixty-two castings per hour is obtained.

After the cage has been placed, open face up, in the fixture, being located from the previously turned periphery, it is indexed to the second station. Here three holes, 0.272 inch in diameter, are drilled through the casting, and three more holes, 0.375 inch in diameter, are drilled to a depth of 0.948 inch. A drill speed of 70 feet per minute is used, the smaller drills being fed 0.005 inch per revolution, and the larger ones 0.004 inch per revolution. Six holes, 0.609 inch in diameter, are drilled through the part at the third station, using the same cutting speed and a feed of 0.009 inch per revolution. These six holes are reamed at the fourth station, using a speed of 50 feet per minute and a feed of 0.013 inch per revolution. Stations 5 and 6 are idle while the work is in the first position.

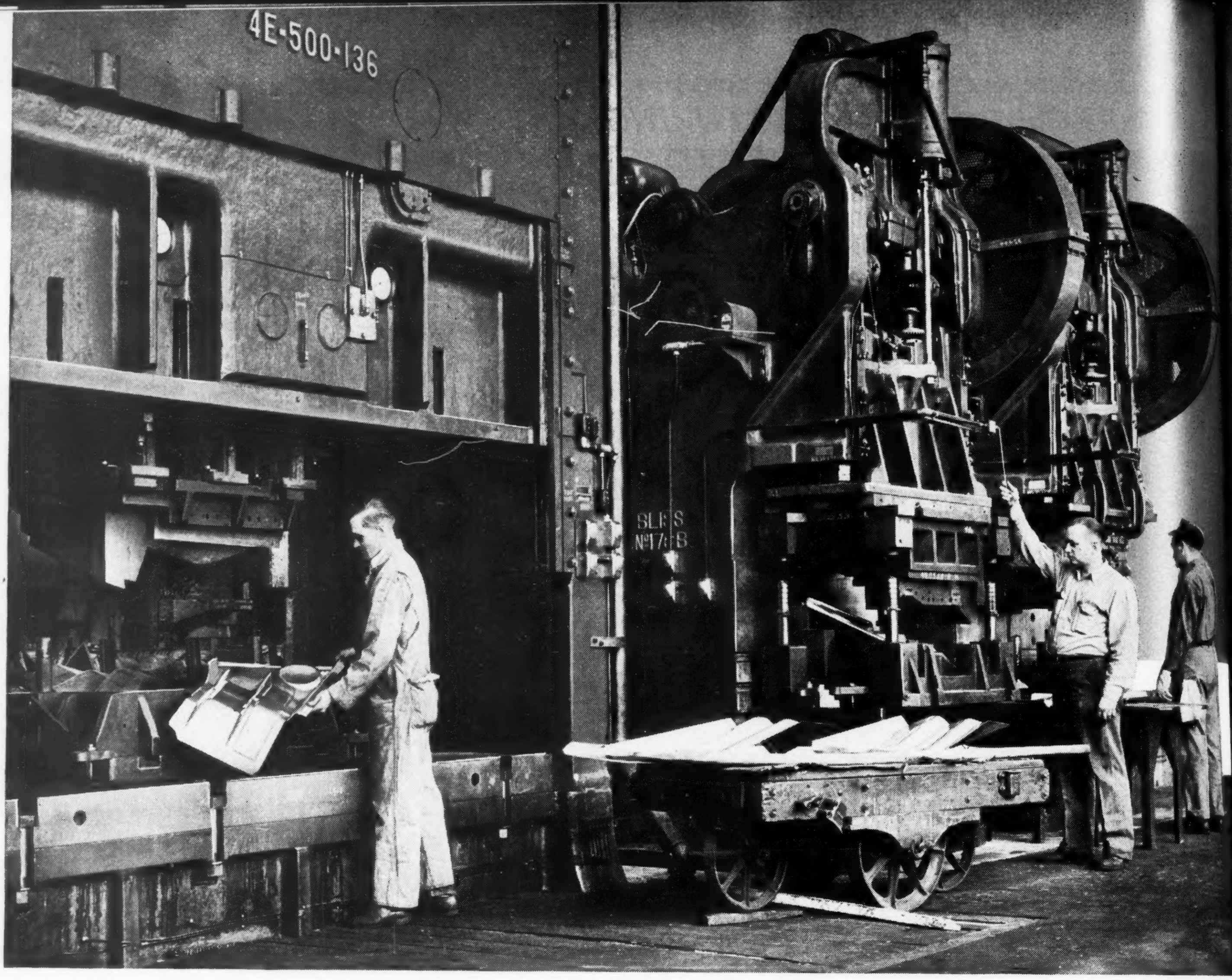
When the work has been relocated and again indexed to the second station, three holes are countersunk and three holes, 0.332 inch in diameter, are drilled through the part. The tool speed is again 70 feet per minute, and the feed is 0.006 inch per revolution. Three of the pinion pockets

Fig. 11. A production of eighty-eight parts per hour is obtained in finishing the joint faces and pinion-pocket faces of both the front planetary cage and the rear planetary-cage assembly

in the cage are counterbored to a diameter of 2.348 inches at the third station. The counterbore speed is 150 feet per minute, and the feed is 0.016 inch per revolution for the first 2 inches of the stroke and 0.005 inch per revolution for the last 1/8 inch. The three remaining pockets are counterbored at the fourth station. Three holes are countersunk at the fifth station and tapped at the sixth station. The 5/16 inch-24 taps are rotated at 35 feet per minute.

The joint face and the faces of the six pinion pockets in the front planetary cage, as well as the same surfaces on the assembly of the rear planetary cage and output shaft, are finished on the Hoern & Dilts four-station precision boring machine illustrated in Fig. 11. Two fixtures are provided at each station, one to hold the front planetary cage, while the other accommodates the rear planetary-cage assembly. The long output shaft on the latter assembly fits into an opening in the rotary table below the fixture.

Two spindles equipped with carbide-tipped milling cutters are provided at the second station, seen at the left, to finish the joint face on each part. Six spindles equipped with carbide-tipped fly-cutters are mounted at both the third and fourth stations to face progressively the six pinion pockets in each part. A cutting speed of 480 feet per minute is employed, and the tools are fed by cams at the rate of 0.002 inch per revolution. With such a light feed and high speed, little pressure is exerted on the work during profile milling, so that it is not distorted, and a smooth, flat surface is obtained on the pocket faces. A production of eighty-eight pieces per hour, or forty-four of each part, is obtained.



MANY unusual stampings are required to produce the distinctive streamline appearance of the new Studebaker. Among these are spinner type grilles, one-piece fenders, and "down-swept" hoods. The drawing and flanging of such large, intricate-shaped components require the use of high-tonnage presses and expensive dies. The panels must be smoothly formed and wrinkle free. Also, close dimensional accuracies must be maintained in the production of the sheet-metal parts to insure ease of assembly and pleasing appearance of the finished product.

High production to meet current demand has been made possible by recent expansion of the manufacturing facilities. Sixty-one new presses ranging in capacity from 75 to 750 tons have been installed at a cost of $3,000,000. With this equipment, stampings for more than 1500 cars per day can be produced. Included in these are fenders, hoods, grilles, instrument boards, fender inserts, and aprons. To maintain this output, 250 tons of steel are used daily. Five carloads of baled scrap a day result from these operations.

Deep-drawing, cold-rolled steel sheets are employed for all stampings. The thickness of the sheets is 19 gage (0.0418 inch) for all parts except the one-piece rear fender, which is drawn from 18-gage (0.0478 inch) stock. Sheets to be used for exposed parts of the automobile are passed through a series of leveling rolls before blanking to eliminate strains in the metal.

Blanking of grilles has been speeded up by the use of a Studebaker-designed automatic unloading device (Fig. 1). The unloader shown is mounted within a blanking die on the bed of a Bliss 265-ton mechanical press used to produce two grille blanks from a sheet 39 inches wide by 85 3/4 inches long. The present production, with only one operator, is 212 blanks per hour, but it is expected that the output on this press, as well as all others, will be increased as the operation of the new stamping plant progresses.

The unloader is tilted by means of an air cylin-

High Production of Difficult Stampings for the New Studebaker

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South Bend, Ind.

Spinner Type Grilles, One-Piece Fenders, and "Down-Swept" Hoods are among the Stampings Required to Produce Studebaker's "New Look." Methods of Forming Such Components Smoothly and to Close Dimensional Accuracies at High Production Rates are Described in This Article

der, which is actuated by a solenoid and limit switch synchronized with the movement of the press ram. As the ram rises, the unloader is automatically tilted upward, as shown, and the completed blank slides over the balls and rollers on the device into a stock tray at the rear of the press. Before the ram begins its next downward stroke, the unloader returns to its position within the blanking die. In blanking very large sheets, it is sometimes necessary to provide an unloading operator. Even in such cases, however, unloading is greatly facilitated and much higher production can be obtained by the use of an automatic unloading device.

The intricate shape of the new Studebaker grille and the depth of draw required make it a difficult part to produce. Relatively sharp corners are specified around the distinctive "spinner" on the grille, and tears are likely to occur in this area during drawing if the sheet metal varies much in thickness, insufficient drawing compound is used, or the die is improperly aligned.

A Clearing 650-ton, two-point suspension mechanical press (Fig. 2) is employed to draw the grilles. The blank for the Commander grille is 37 inches wide by 51 1/8 inches long, while that for the Champion grille is 37 inches wide by 42 7/8 inches long. One operator applies drawing compound with a spotting brush to critical areas on the flat sheet. Another operator loads the blank into the die, while the operator shown unloads the drawn grille. Two air-actuated ejectors lift the drawn grille from the die as the press ram rises.

After blanking out the openings in the drawn grille, the entire periphery of the part and the edges of all openings are flanged simultaneously by means of the set-up shown in Fig. 3. The flanging die is mounted on one side of a Bliss 500-ton mechanical press, the opposite side of the press being employed for another operation. Flanges formed around the spinner, large grille, and bumper-bar bracket openings are about 1 1/4 inches wide, while the long flange on the bottom of the grille has a maximum width of 6 inches.

An air pad in the lower die provides an 11-inch travel for flanging. The flanged grille is automatically ejected from the die by a me-

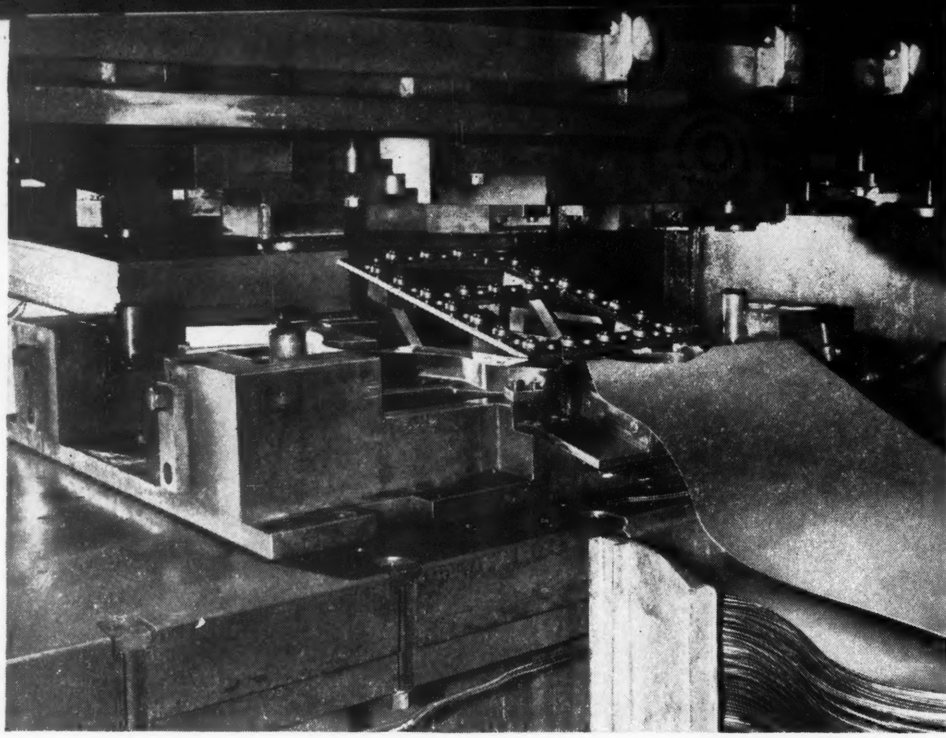


Fig. 1. An automatic unloading device that is mounted within a blanking die speeds up the production of grille blanks

chanical stripper. A pin, mounted on the punch, expands a ring in the die, which pushes against the flat nose of the spinner to eject the part from the die.

The most difficult stamping to produce for the 1950 Studebaker is the one-piece rear fender. Conventional fenders are of two-piece or "welded patch" design, as is the case with the Studebaker front fender. The size of the rear fender and the deep draw required (8 3/4 inches maximum) necessitated changing from 19-gage to 18-gage sheet steel in order to minimize tearing during drawing. Now, scrap averages 3 per cent—a low figure considering the design of the part.

Drawing of the one-piece rear fenders is performed on Clearing 750-ton mechanical presses, such as the one seen in Fig. 4. Two such presses are employed, one for drawing left-hand rear fenders, and the other for right-hand ones. A gasoline-tank filler-hole depression is formed in the left-hand fenders only. The flat blanked sheets, 39 inches wide by 85 1/4 inches long, are pre-formed by hand, one end being bent upward as shown, before the blank is placed in the draw-

Fig. 2. Intricate-shaped, deep-drawn grilles are produced from flat blanks 37 inches wide by 51 1/8 inches long on a 650-ton mechanical press

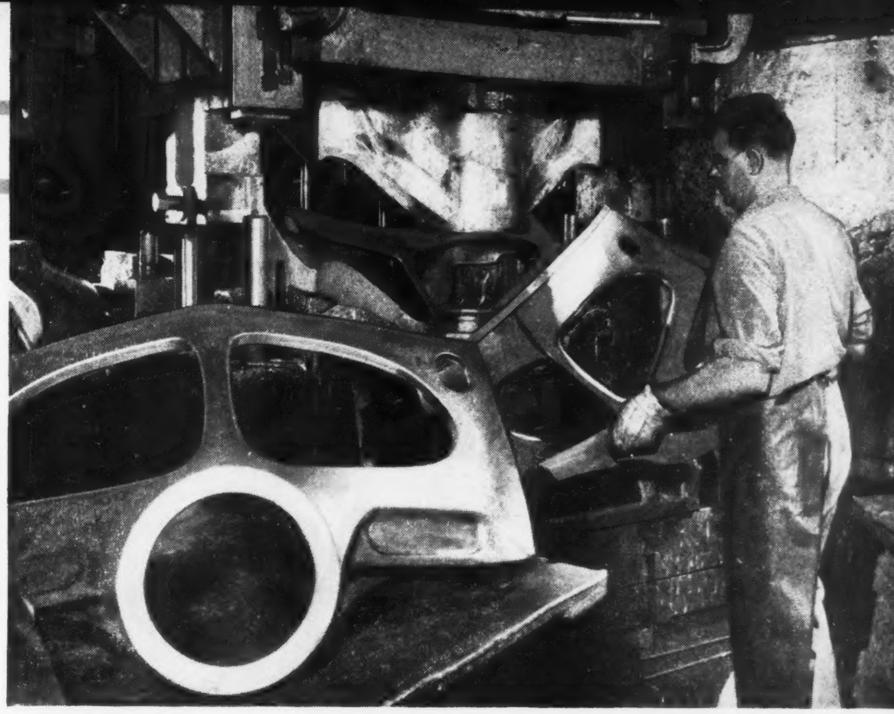


Fig. 3. The entire periphery of the drawn grille and the inner edges of all blanked openings are flanged simultaneously in this set-up

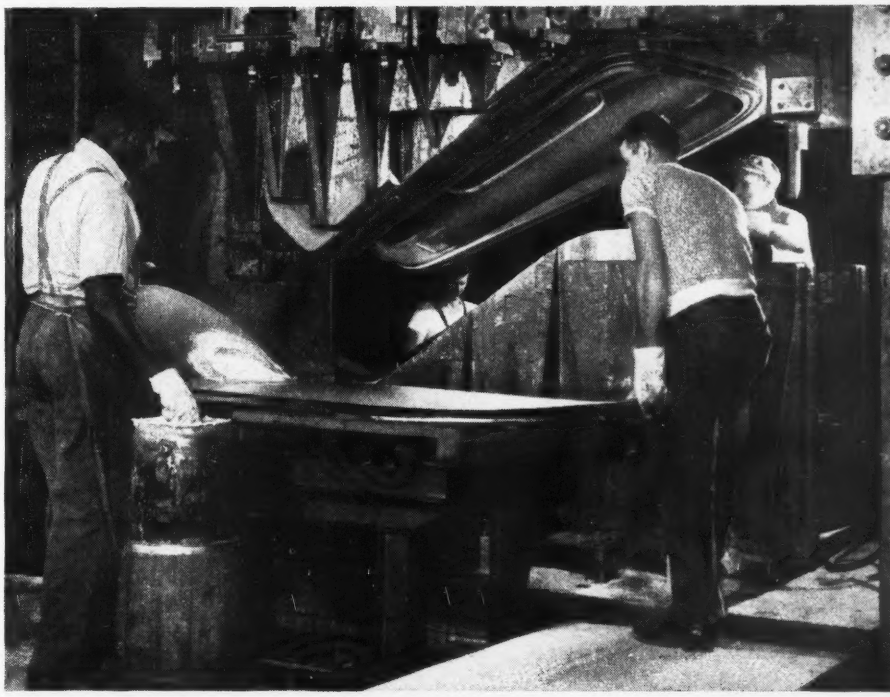


Fig. 4. Flat blanks for the one-piece rear fenders are pre-formed by hand, one end being bent upward before the blank is placed in the drawing die

Fig. 5. One-piece rear fenders are drawn to a maximum depth of 8 3/4 inches from sheets 39 inches wide by 85 1/4 inches long

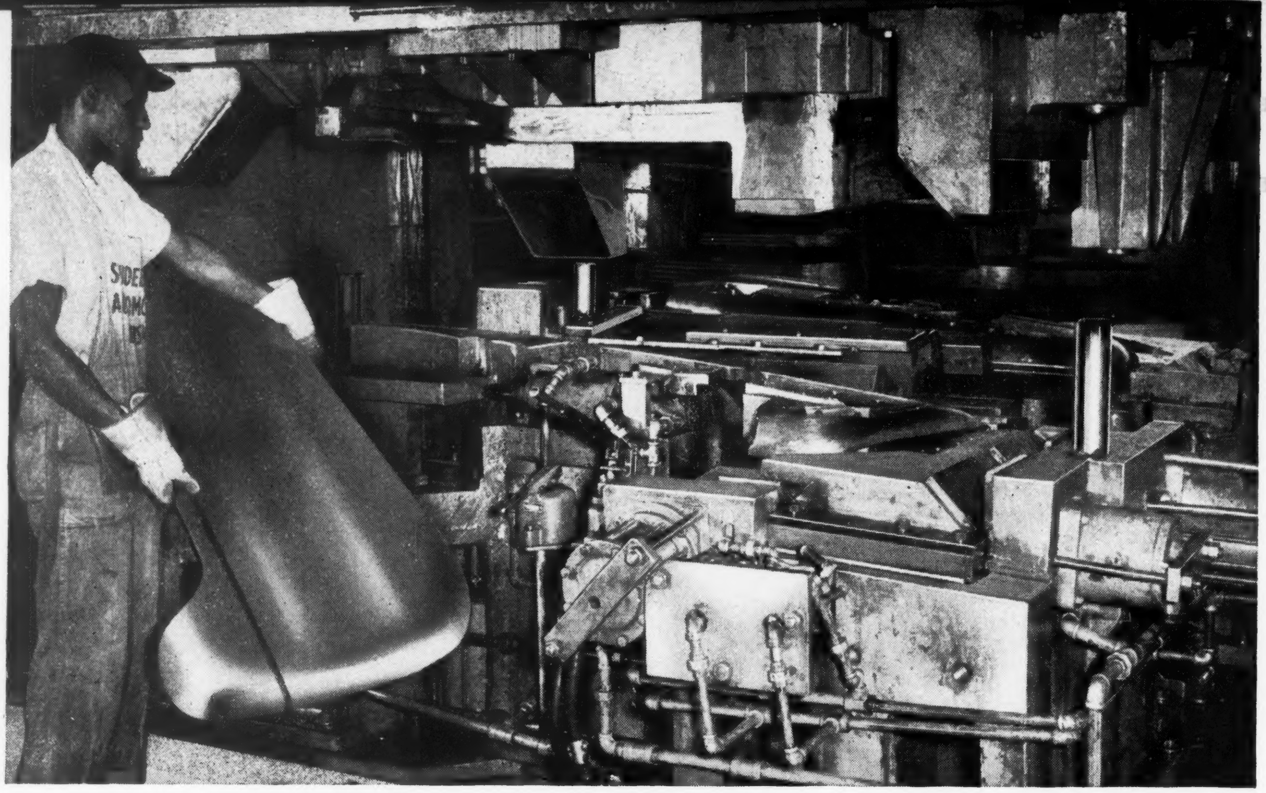


Fig. 6. Two cam-actuated collapsible dies are mounted on a 500-ton mechanical press for simultaneously flanging both the left- and right-hand fenders

ing die. Drawing compound is applied to that area of each blank which will be formed into the tail-lamp embossment. Compound is also applied to the draw-ring after drawing every fourth or fifth panel. Two gage holes are pierced in the part during drawing. A drawn fender is shown being removed from the press in Fig. 5. The current production from each press is 180 fenders per hour.

After the rear fenders have been trimmed, the body and bumper flanges are formed in the set-up shown in Fig. 6. This operation is performed on both left- and right-hand fenders at the same time by a Clearing 500-ton mechanical press. Two cam-actuated, collapsible flanging dies are mounted on the press bed, which is 148 inches long by 72 inches wide.

Cast-steel jaws are provided on the five inter-slides of the die for gripping the fender. There are fourteen air cylinders on the die which collapse the inter-slides during loading and move them outward against the fender during flanging. Two of the air cylinders actuate cams, which lock the slides in their outermost positions while the flanging operation is being performed. The flanging steels, mounted on horizontal acting cams on the lower die, are driven toward the work by vertical acting cams on the upper die.

Fig. 7. Hoods are drawn from flat steel blanks 64 3/4 inches wide by 72 inches long on the 750-ton press illustrated

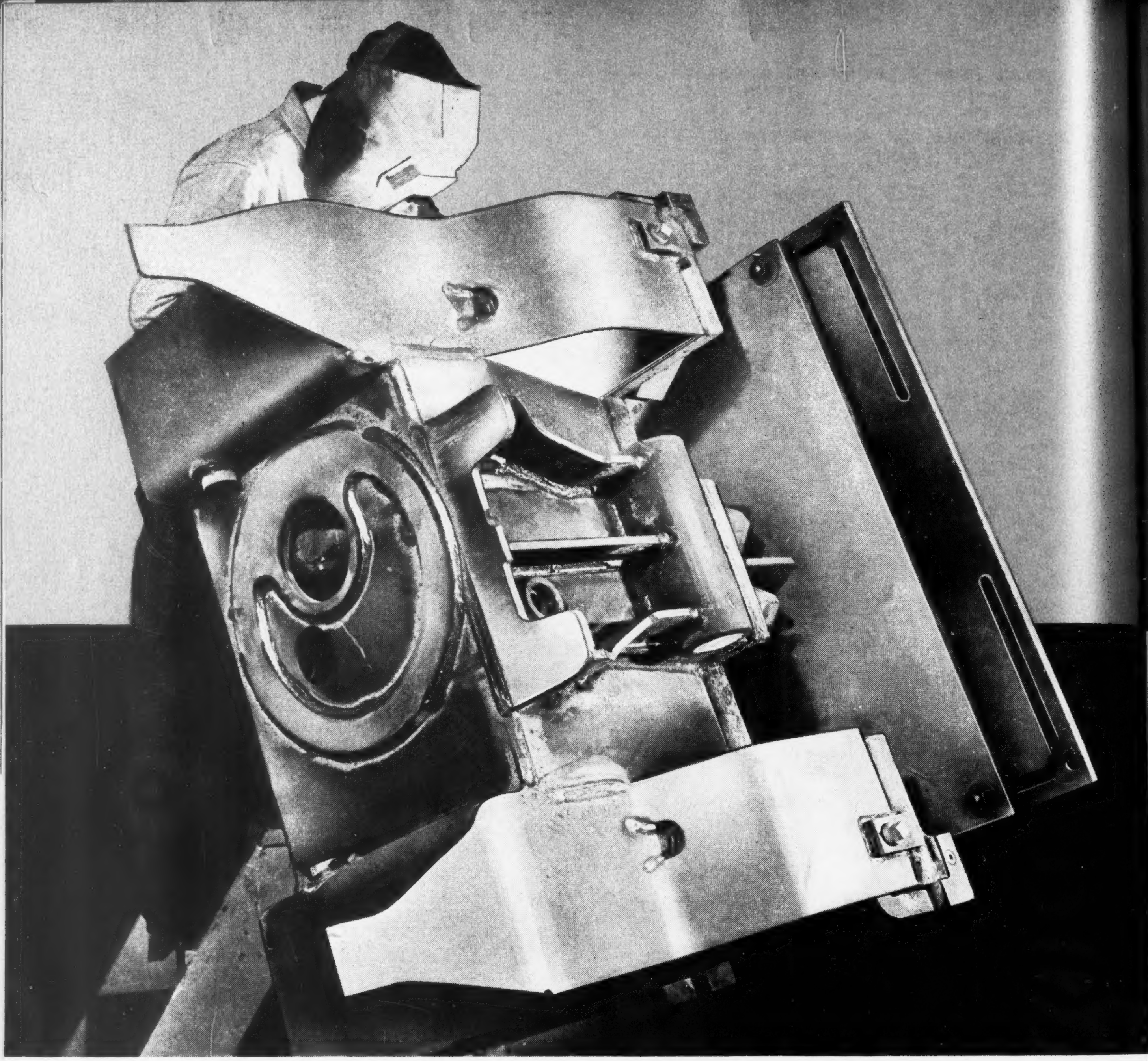
Fig. 8. A completed hood being removed from the drawing die. Four air-actuated ejector pins lift the part from the die

The graceful "down-swept" hood is drawn in one operation on a Clearing 750-ton mechanical press, as seen in Figs. 7 and 8. Four operators are required to load the blank, which is 64 3/4 inches wide by 72 inches long, and two operators remove the drawn hood from the rear of the press. Four air-actuated ejector-pins are provided in the lower die to lift the completed part. One of the loading operators wipes the flat blank with a rag mop to remove grit or other foreign matter. Another operator applies drawing compound to the leading edge of the blank.

A $40,000 cam-actuated die, mounted on a Bliss 500-ton mechanical press (Fig. 9), is employed to flange the hood. Both sides of the hood are flanged to a double angle, the trailing edge of the panel containing two locating holes is sheared from the hood, and the back edge of the hood is formed to a 90-degree flange in one operation. Four operators are required, two for loading and two for unloading the die.

Form blocks in the lower die are contracted for loading and spread apart to grip the hood during flanging by a double-acting "push and pull" cam seen at the left. The same cam actuates a locking device to hold the form blocks in place during flanging. The flanging steels are moved toward the hood by two right- and two left-hand vertical acting cams mounted on the upper die. At the completion of the flanging operation, the flanging steels are retracted by the action of two air cylinders on each side of the die. A spring-actuated pressure pad is provided in the upper die.

Fig. 9. A cam-actuated die is used to flange both sides of hood to a double angle, flange rear end of hood, and trim off gage tabs



BY constant improvement in product design, and the modernization and expansion of facilities, the Caterpillar Tractor Co., Peoria, Ill., has attained a leading place in the production of Diesel engines, track type tractors, and road-building machinery. The latest steps in the company's post-war expansion program have been the additions of a new Diesel engine factory with an area of 925,000 square feet and a new steel fabrication factory of 875,000 square feet area.

One of the outstanding production lines in the steel fabrication factory is employed in manufacturing steering-clutch and bevel-gear housings for huge Diesel-powered tractors. The housings are fabricated by welding together blanked and formed steel plates from 1/4 to 5/8 inch thick and large steel castings. The weldments, weighing approximately 1800 pounds each, are machined to precision tolerances.

The steering-clutch cases were previously of one-piece cast-iron construction. By adopting welded steel construction, a lighter, stronger, and better quality housing was obtained. Also, maintenance in the field is facilitated, since repairs can be made by welding. Another advantage of the new design is that the case can be attached directly to the main frame arms of the tractor, making an integral assembly. Stub arms, welded to the case prior to machining, permit welding

Large Production Equipment Required for Caterpillar Steering-Clutch Cases

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Weldments Weighing about 1800 Pounds Each Serve as Housings for the Steering Clutch and Bevel Gears on Diesel-Powered Caterpillar Tractors. In Producing These Housings, Steel Plates as Thick as 5/8 Inch are Blanked, Formed, and Welded Together, and the Welded Assemblies are Machined to Precision Tolerances

the case to the tractor frame at assembly without distorting the accurately machined surfaces.

As is often the case in improving the design of a product, many difficulties were encountered in manufacturing. In determining the sizes of the component parts of the weldment, allowance had to be made for warpage, shrinkage, and expansion occasioned by welding. The need for oil compartments in the intricate-shaped weldment necessitated pressure-tight welding. The sequence followed in welding the various components was determined by trial.

One component of the steering-clutch case—a bevel-gear bearing support plate—is seen at the right in Fig. 1. Pickled and oiled hot-rolled steel plates are employed for this part. The plates, 3/8 inch thick by 24 inches wide and 11 feet 10 inches long, are cut to blank size (20 1/4 inches long) on a Cincinnati shear. Blanks are progressively pierced, formed, and trimmed, as seen in Fig. 1, on the Clearing 1600-ton mechanical press illustrated in Fig. 2. Four dies, are mounted side by side on the 16-foot bed of this press. The parts are moved progressively from station to station by two operators, resulting in a production of sixty support plates per hour from one press.

On the first die, an 8-inch diameter hole near the center of blank *A* is rough-pierced, producing the part seen at *B*, Fig. 1. The five ribs projecting radially from this hole, as seen at *C*, are formed on the second die. The center of the plate is also conically dished to a depth of 3/16 inch on this die. All four sides of the plate are trimmed, as indicated at *D*, on the third die. This die is also employed to "shave" or finish-pierce the 8-inch diameter hole. About 3/8 inch of stock is removed from the diameter of the hole in the "shaving" operation. A notch is cut in one edge of the blank, as seen at *E*, by the fourth and final die. After the burrs have been removed and the parts have been washed to remove the drawing compound, the bevel-gear bearing support plates are ready to be welded to the steering-clutch case assemblies.

A 3500-ton hydraulic press, made by the Hydraulic Press Mfg. Co., is employed for blanking parts from 5/8-inch steel plates. The press

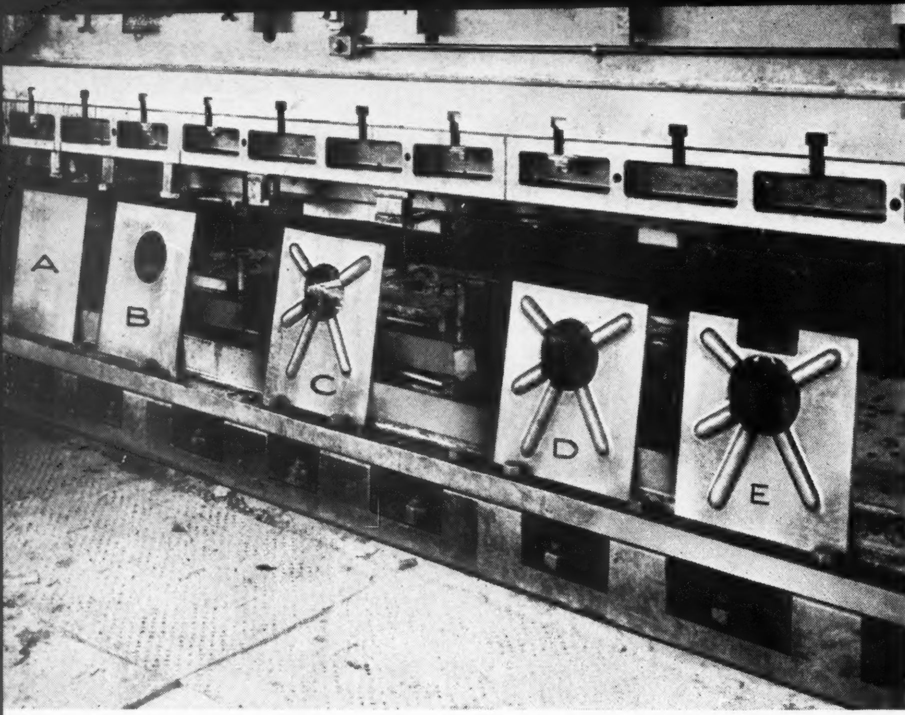


Fig. 1. Progressive shapes produced in manufacturing bevel-gear bearing support plates for steering-clutch cases. The sheared blank is seen at left and a completed plate at right

is equipped with a 1000-ton pressure cushion, which permits plates of this thickness to be blanked, and at the same time, close flatness tolerances to be maintained. Thus, since the blanked plates do not require straightening before they are welded to the assembly, manufacturing costs are substantially reduced.

The set-up employed on this huge press for blanking and piercing the top plates of the steering-clutch cases is shown in Fig. 3. Pickled and oiled hot-rolled steel plates, 5/8 inch thick by 26 inches wide by 92 inches long, are sheared in half to provide the 46-inch long blanks for this operation. Two operators are required to load the heavy blank on a gravity roller conveyor leading to the die and unload the com-

Fig. 2. Four dies are employed on this 1600-ton mechanical press to produce the bevel-gear bearing support plates seen in Fig. 1

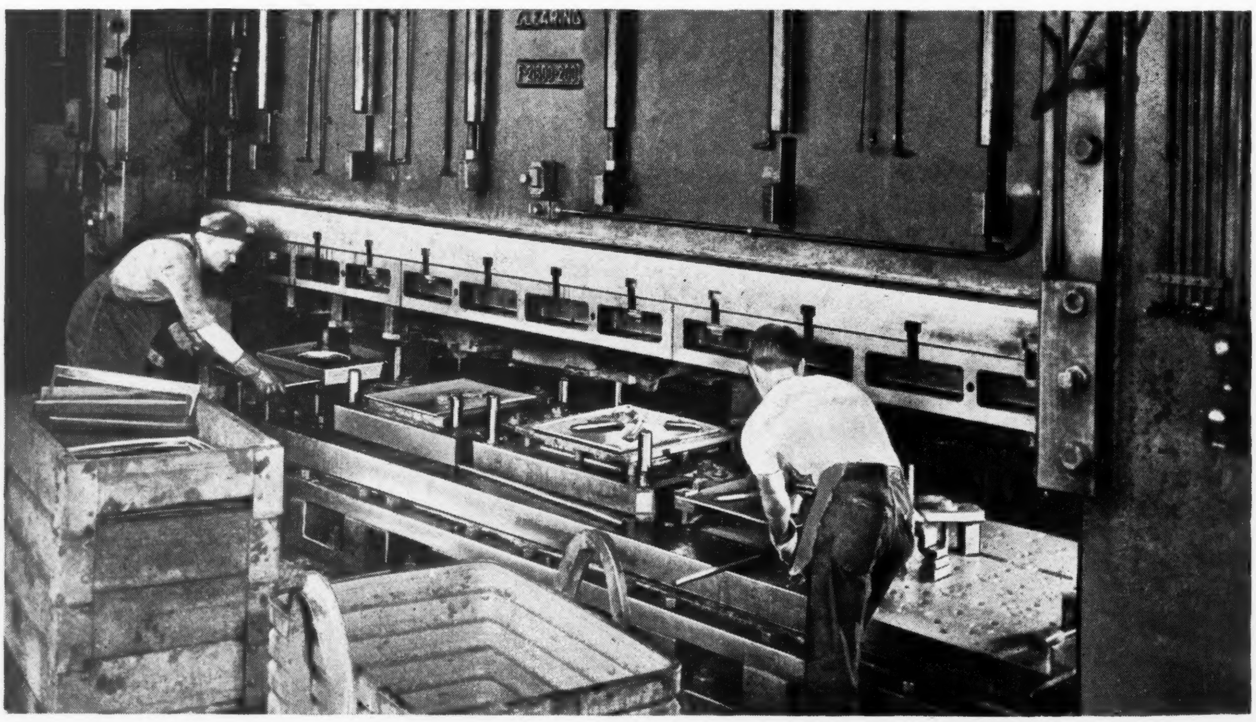


Fig. 3. Top plates for the steering-clutch cases are blanked and pierced from 5/8-inch thick stock on a 3500-ton hydraulic press that is equipped with a 1000-ton pressure cushion

pleted part. A production of thirty-six plates per hour is obtained.

All four sides of the rough blank are trimmed to size, removing about 1/2 inch of stock per side, by punch members mounted in the upper die-shoe. Punches for piercing the three irregular-shaped cover openings in the blank are carried in the lower die-shoe. The stock is gripped between the upper punch members and a pressure plate that is supported by pins projecting upward from the hydraulically actuated cushion in the bed of the press. Sufficient pressure is exerted by the cushion to hold the part flat while it is being carried down into the die and during the blanking and piercing operations. Stripper plates, actuated by the ram, are provided in the upper die-shoe to remove the slugs and scrap.

The cutting steels in the upper die-shoe are ground flat, while shear is provided on the steels

Fig. 4. Blanked and formed steel plates and welded sub-assemblies and steel castings are tack-welded into a box section in this fixture

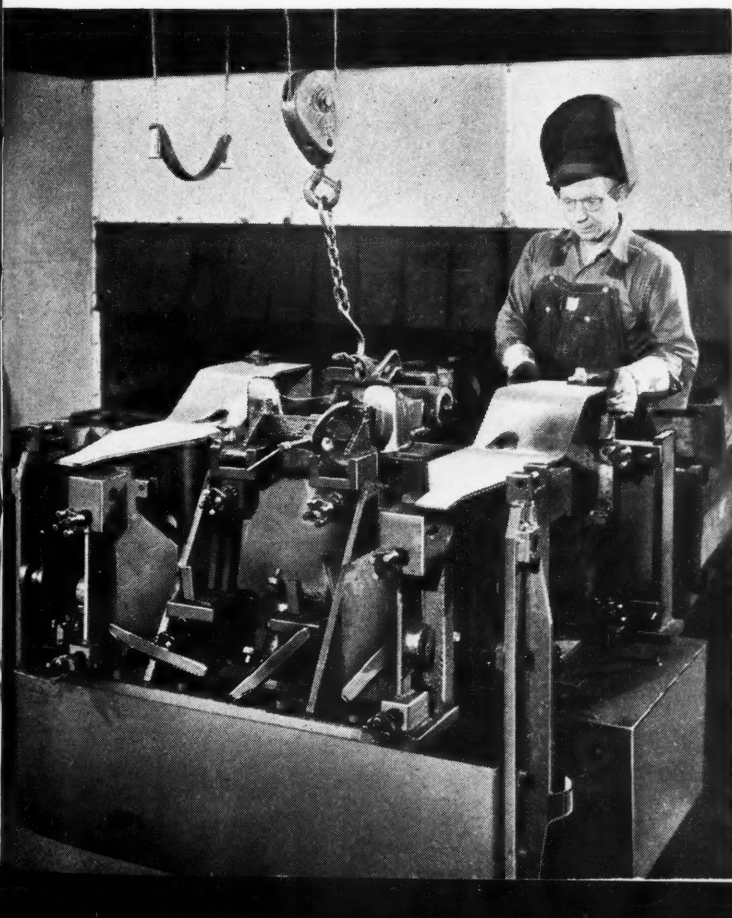
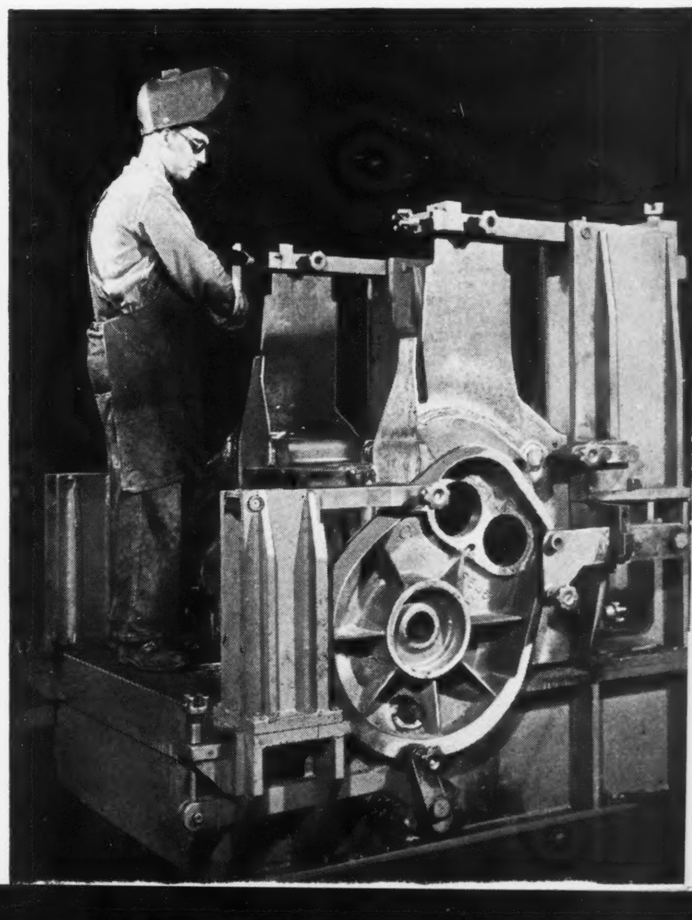


Fig. 5. In this fixture, the side-plate sub-assemblies are tack-welded to the box section of the bevel-gear and steering-clutch case



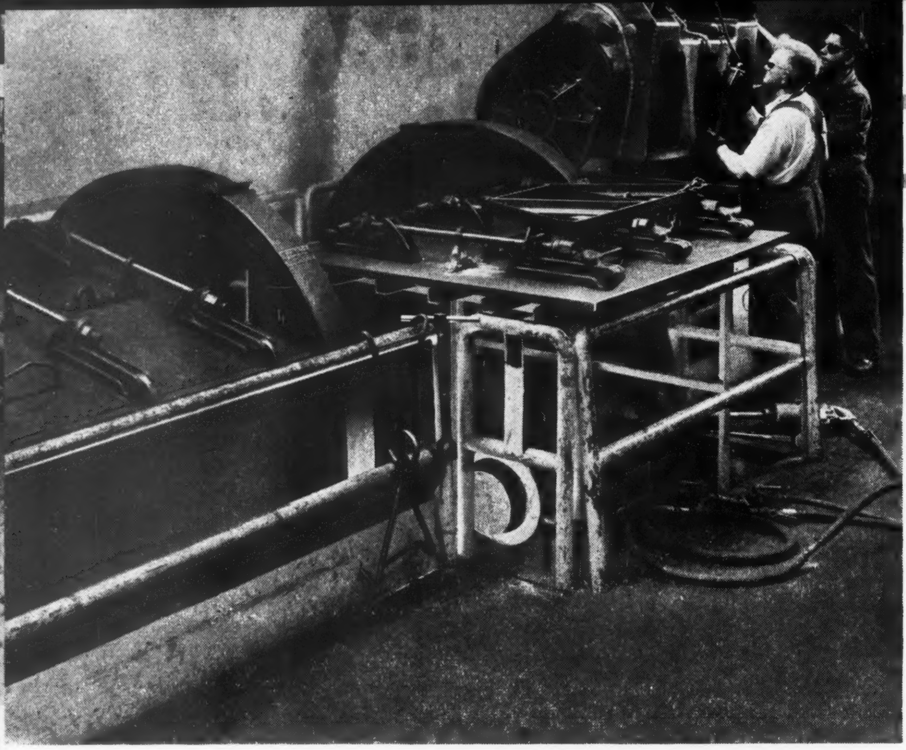
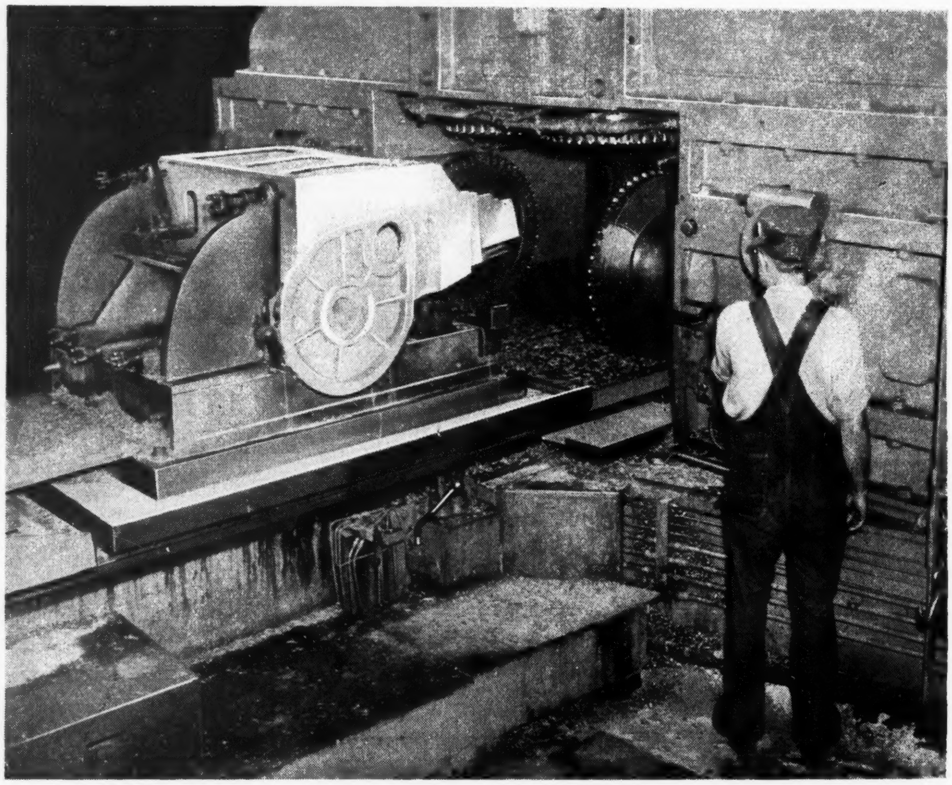


Fig. 6. (Left) Welded steering-clutch case assemblies are cleaned and stress-relieved by tumbling. Star-shaped. hardened steel shot is used in the tumbling operation

Fig. 7. (Right) The top and both sides of the large weldment are milled simultaneously in this operation, maintaining parallelism within a tolerance of 0.003 inch



in the lower shoe. Also, the cutting steels in the lower die-shoe are "stepped" to lighten the cutting load required. This combination of shear and "stepping" distributes the load, so that steady, even cutting is obtained with a minimum amount of pressure and noise. An over-all clearance of 0.094 inch (15 per cent of the blank thickness) is provided between mating punch and die members. To minimize the danger of chipping, no relief is provided on the vertical faces of the cutting steels, and galling is avoided by using adequate lubricant.

An air-hardening tool steel is employed for the die members, resulting in long die life, approximately 2500 blanks being produced between grinds. Sufficient dimensional accuracy and flatness are maintained to enable the top plates to be used directly in fabricating the large steering-clutch case weldments without straightening or machining.

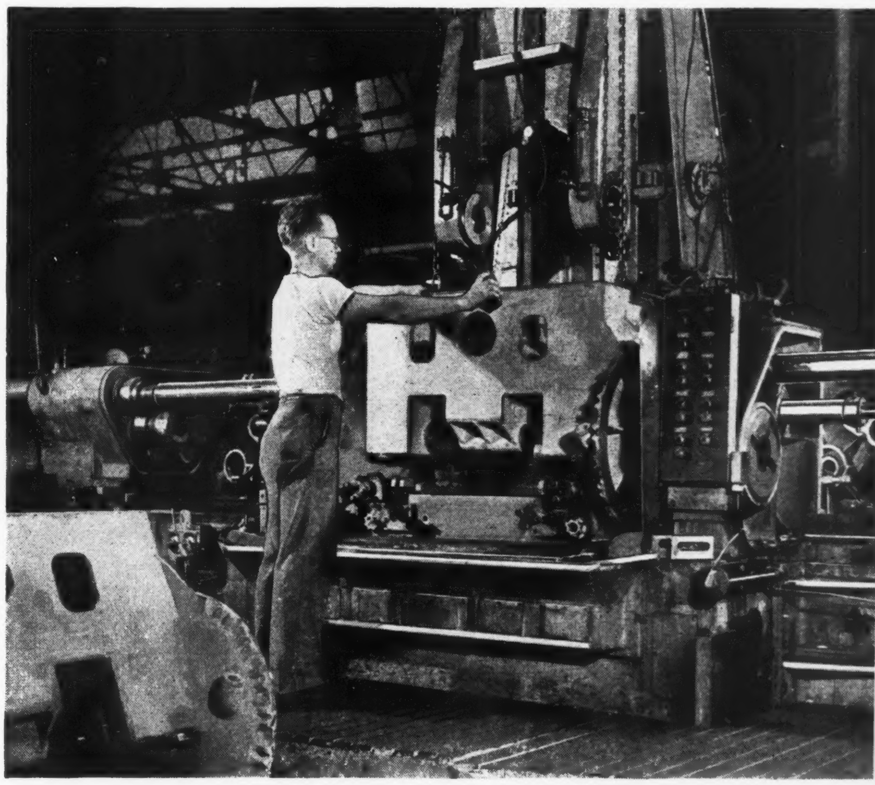
Blanked and formed steel plates, welded sub-assemblies, and cast-steel members flow to assembly and tack-welding fixtures, such as the one seen in Fig. 4. Originally, all parts of the steering-clutch case assembly were tack-welded together in such fixtures. However, dimensional accuracies could not be maintained with this method because of the distortion encountered. Now only the box section of the assembly is formed in the first tack-welding fixture, and the cast steel end plates, stub frames, and end bosses are tack-welded to the assembly later, as seen in Fig. 5. Even with this procedure, the sub-assemblies must be made to a predetermined size and shape to obtain the desired size after welding. For example, the top plate of the steering-clutch case is blanked to an over-all length of 44 13/16 inches to obtain a length of 44 3/4 inches after welding.

After the tack-welding operations, the assembly is progressively moved from station to station on the welding line. Ransome welding positioners, provided at each station, permit rotating the assembly to the desired position. Approximately 20 pounds of electrodes are used in welding the sub-assemblies for each steering-clutch case, while 50 pounds more are consumed in the final welding of the assembly. American Welding Society E-6020 (Type 2) and E-6013 (Type 1) electrodes are employed, using from 320 to 370 amperes (alternating current) for the metal arc-welding operations.

Completely welded assemblies are loaded into the Whiting tumbling machines seen in Fig. 6, where they are rotated at 14 R.P.M. for one-half hour in each direction for cleaning and relieving stresses. The cases do not move within the barrel of the machine, being held by the cover and clamps. Star-shaped, hardened steel shot rolls around in the barrel, bouncing from deflection plates and striking all surfaces of the steering-clutch case. An air exhaust fan is connected to each barrel to remove the pulverized slag and dirt. The stresses are sufficiently relieved in this way to make a subsequent furnace treatment unnecessary.

Pneumatic chipping hammers are used to further clean the weldments prior to testing. In testing, the entire steering-clutch case assembly is sealed, after which compressed air is intro-

Fig. 8. Bearing holes in the steering-clutch case are rough- and finish-bored and the joint faces and four internal surfaces are faced on this special three-way hydraulic machine



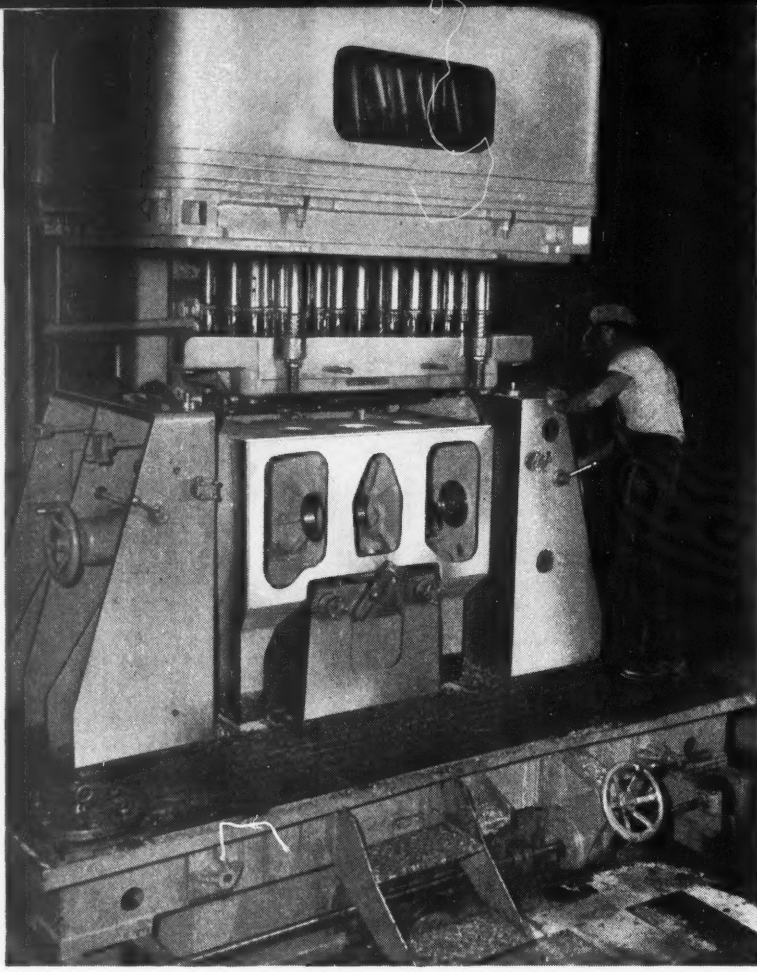


Fig. 9. Thirty-four holes varying from 5/16 inch to 1 7/64 inches in diameter are drilled in rear face of steering-clutch case assembly in this operation

duced into the oil compartments. Soapy water is applied to the exterior surfaces of the case to detect bubbling of the compressed air through the welded surfaces. Very few cracks are formed in welding the cases, but porosity or air-passage holes at the roots of the welds are occasionally detected during testing. Following this test, locating pads are milled on the cases, stub frames are straightened, and the weldments are washed and painted prior to machining.

Both sides and the top of the welded housings are milled on the large Newton milling machine seen in Fig. 7. Approximately 1/8 inch of stock is removed from each surface, using two milling cutters 26 inches in diameter, two cutters 31 inches in diameter, and one cutter 3 1/2 inches in diameter. The inserted-tooth cutters are rotated at 9 R.P.M., and the table on which the work-holding fixture is mounted is fed past the cutters hydraulically at the rate of 28 inches per

Fig. 10. Two steering-clutch cases are mounted side by side on the table of this side-acting, multiple-spindle drilling machine. Forty-one holes are drilled in each end of the weldments

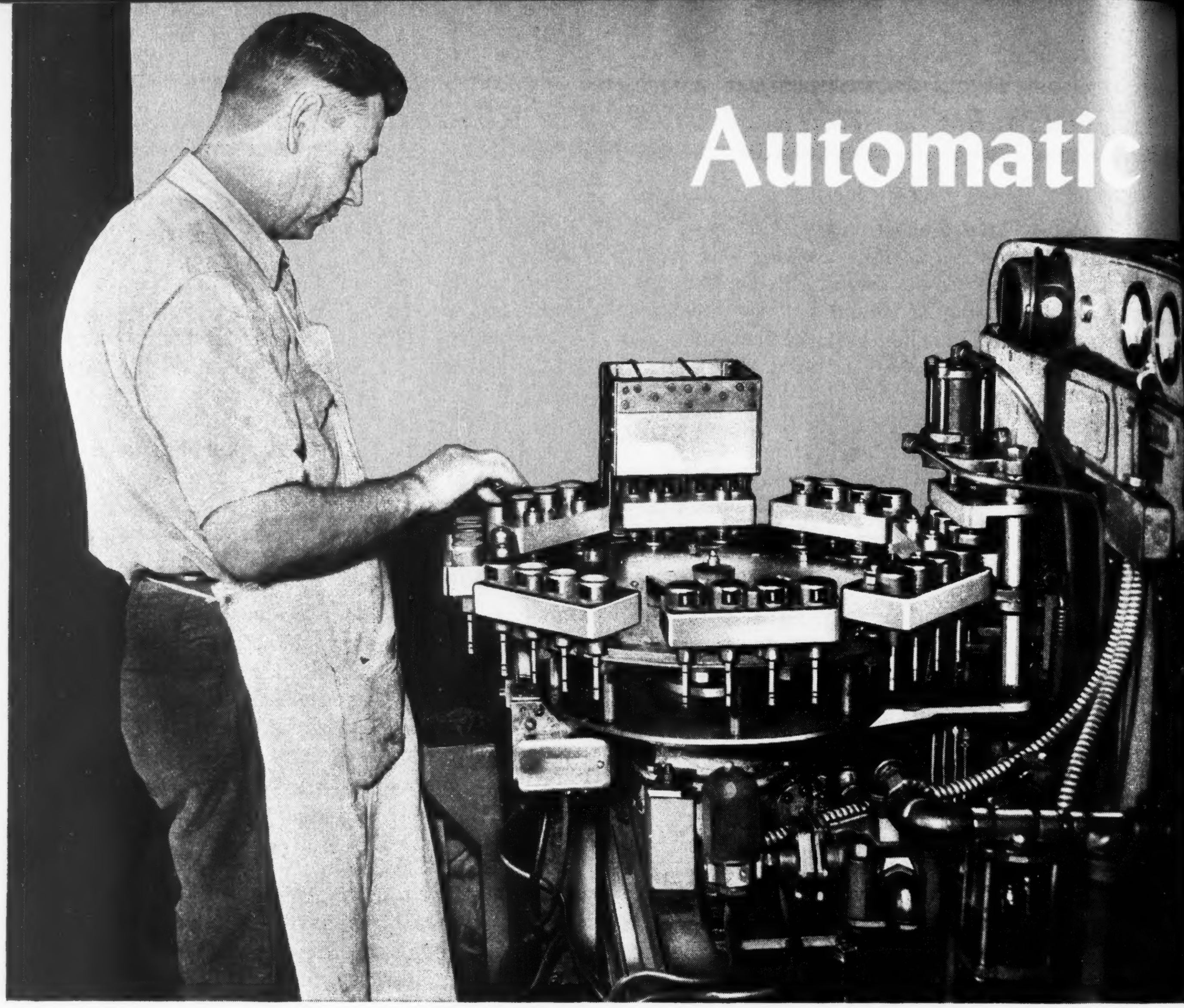
minute. A rapid table traverse of 50 inches per minute is provided for the advance and return stroke, giving a production of thirteen housings per eight-hour day. The sides of the weldment are maintained parallel, and the top surface is held square with the sides within 0.003 inch total tolerance.

The special three-way hydraulic machine seen in Fig. 8 was built by the Caterpillar Tractor Co. to bore and face the steering-clutch case assemblies. Originally designed for manual control and for use with high-speed steel tools, the machine is now semi-automatic in operation, and is equipped with carbide tools. Production has been increased from four to seven weldments per eight-hour shift. Two-speed motors are provided to rotate the boring-bars at 50 R.P.M. for roughing and at 100 R.P.M. for finishing. Stock removal averages about 1/16 inch. The feed of the boring-bars is 0.010 inch per revolution for roughing and 0.005 inch per revolution for finishing.

The operating cycle consists of rough-boring the bearing holes, rough-facing the joint face of the steering-clutch case, rough-facing four surfaces inside the weldment, finish-facing the same four surfaces, and finish-boring the bearing holes. It is necessary to replace the rough-facing tools before finish-facing and boring the part. The traveling tool-head for machining the joint face is not visible, being mounted on the center vertical column of the machine behind the work. The facing tool on this head travels through a circular path having a radius of 21 inches. The head is rotated at 22 R.P.M. and fed at the rate of 100 inches per minute. Bearing holes are bored within $\pm$ 0.0005 inch, and the distance from the joint face to the center line of the steering-clutch shaft bore is held to a flat dimension, no tolerance being allowed.

Thirty-four holes ranging in diameter from 5/16 inch to 1 7/64 inches are drilled in the rear face of the steering-clutch case assembly on the Natco multiple-spindle machine shown in Fig. 9. The traveling table provided on the machine facilitates loading. A similar machine is employed to drill fifty-one holes in the top surface of the weldment. The drills are rotated at 90 surface feet per minute, and fed at rates varying from 0.003 to 0.022 inch per revolution.

For drilling eighty-two holes in the ends of the welded cases, two of the cases are mounted side by side on the table of the side-acting, multiple-spindle drilling machine seen in Fig. 10. After forty-one holes have been drilled simultaneously in one end of each case, the parts are rotated through 180 degrees and the same number of holes are drilled in the opposite end.



Automatic

SELECTIVE surface hardening of steel parts by means of induction heating is being increasingly applied. The process of induction heating takes advantage of the fact that heat is generated in a magnetic material when such a material is placed within the magnetic field produced by high-frequency current passing through a coil.

The major advantages of induction hardening are the rapidity with which parts can be heated and the minimizing of distortion, scale, and decarburization. The time required for heat-treatment has been reduced in some instances from hours to seconds. Selective hardening can be accomplished without copper-plating or masking the surfaces that are to remain soft.

Some parts previously made from alloy steel to allow oil quenching after carburizing are now made from less costly carbon steel because distortion does not occur with induction hardening. Specified hardnesses are readily obtained, due to the automatic operation of induction heating equipment. The compactness of such equipment permits it to be placed directly in machine shop production lines. Thus handling of the parts is minimized, as transfer to and from a centralized heat-treating department is eliminated. Carbon steels in the range of S A E 1035 to 1060 are used for induction hardening, depending on the application.

An outstanding application of induction heating at the Dodge Division of the Chrysler Corporation is in the hardening of cams on transmission countershaft gears forged from AISI 4032 steel. Because of the severe wear to which these cams are subjected, it is necessary to provide a greater depth of hardened case on the cam periphery than on other surfaces of the part. Heretofore, this was accomplished by a double carburizing treatment, which necessitated rough-turning of the forging, copper-plating, semi finish-turning of the cam periphery to remove the

Induction Hardening Speeds Dodge Output

By CHARLES H. WICK

Applications of Selective Surface Hardening by Means of Induction Heating, which have Resulted in Faster Heating and Minimum Distortion and Scaling

copper, carburizing of this surface to a depth of 0.060 inch, machining to remove the remaining copper, box carburizing, and direct quenching. The case depth on the cam after the second carburizing treatment was about 0.080 inch, while other surfaces on the forging had a case approximately 0.040 inch deep.

Now the forging is finish-machined (including cutting of the teeth), the cam periphery is semi finish-machined, and the part is gas carburized and quenched, after which the periphery of the cam is reheated by the induction method and then water-quenched on a 100-K.W., 9600-cycle induction hardening machine, Fig. 1. Gas carburizing gives a case depth of about 0.040 inch on all desired surfaces, while induction hardening increases the hardness depth on the cam surface to approximately 0.100 inch. Semi finish-turning of the forging, copper-plating, carburizing of the cam surface, and other related operations are no longer necessary. Also, the machinability of the part is improved by eliminating the box cooling formerly required after carburizing the cam surface.

In the induction heat-treating of the cam, the countershaft gear is slowly rotated and elevated so that the cam at one end of the part is within the inductor coil. Each part is loaded, raised, heated, quenched, lowered, and unloaded in a 21-second cycle, giving a production of 169 countershaft gears per hour. After induction hardening, the periphery of the cam has a hardness of 61 Rockwell C on its surface, and about 55 Rockwell C at 0.080 inch below the surface. Line voltage (440 volts) supplied to the machine must be held within $\pm$ 4.4 volts to maintain the average case depth within $\pm$ 0.004 inch. This is accomplished by placing a voltage regulator between the source of current supply and the machine.

Another application of selective hardening by the induction method is the hardening of valve-stem ends which are hardened at the rate of 1250 valves per hour, as seen in the heading illustration. An electronic-tube type induction heater having an output of 20 K.W. at a frequency of 450,000 cycles is employed. Eight stations are provided on the rotary table of the machine, each of which holds four valves. As each set of four valves is indexed and lowered into the inductor coils, seen at the right, they are heated for three seconds, allowed to dwell for one second, and water-quenched for one second. A hardness of from 55 to 60 Rockwell C is obtained for a depth of 1/8 inch on the stem end. The temperature of

Fig. 1. Transmission countershaft gears are selectively induction hardened after gas carburizing to obtain an increased depth of case on the cam surface

the quenching water is maintained at 90 degrees F. by a thermostat.

In addition to almost tripling the output per operator, induction hardening of valve ends has eliminated scale and distortion. Also, since the induction heater is compact and completely self-contained, it is installed directly in the machine shop production line, thus eliminating handling and trucking to and from the heat-treating department.

Continuous, selective casehardening of transmission gear shift rails at the rate of 400 per hour is performed on the 10-K.W., 450-kilocycle radio-frequency induction hardening machine illustrated in Fig. 2. Operation is made automatic by a magazine-fed loading device. Manual refilling of the magazine is required only at eight-minute intervals. The rails are hardened to a uniform depth by passing through an inductor coil and spray quench ring as they are rotated about their longitudinal axis. Four different lengths of gear shift rails, all 1/2 inch in diameter and made from normalized S A E 1046 steel, can be handled on one machine by simply changing the magazine and plugging in the proper timer selector.

Hardness is confined to specified areas, insuring hardening of shoulders on the circumferential grooves of the rails, by electronically turning the radio-frequency power on and off at precise time intervals as the work progresses through the inductor coil. In this operation, a minimum hardness of 60 Rockwell C and a case depth of 0.100 inch are obtained.

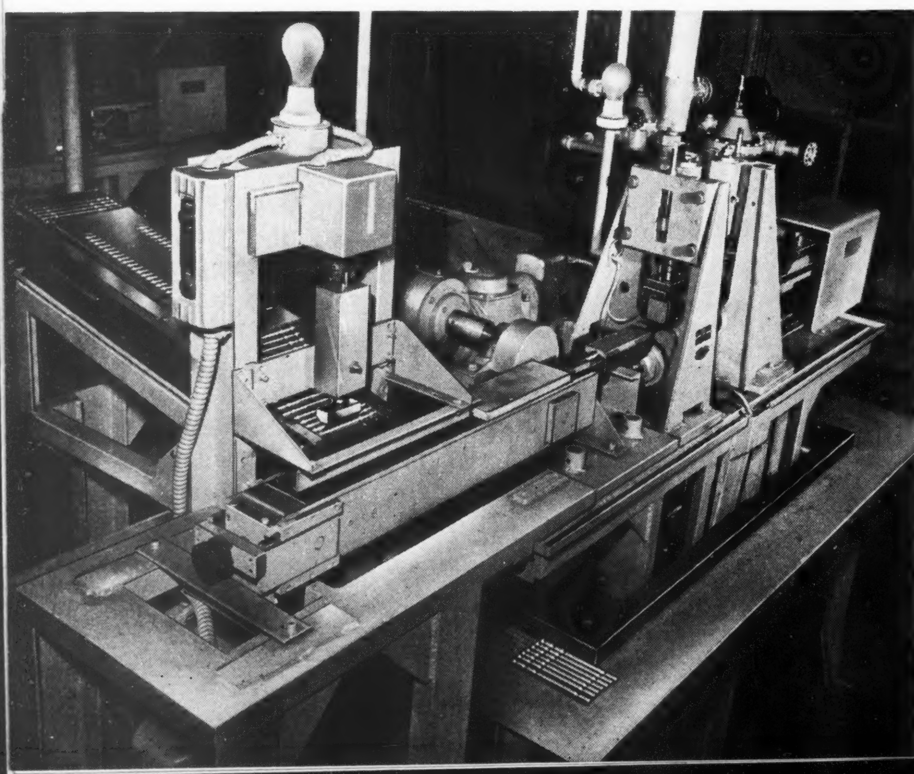


Fig. 2. Transmission shifter rails are selectively casehardened at the rate of 400 an hour with the radio-frequency induction hardening set-up illustrated

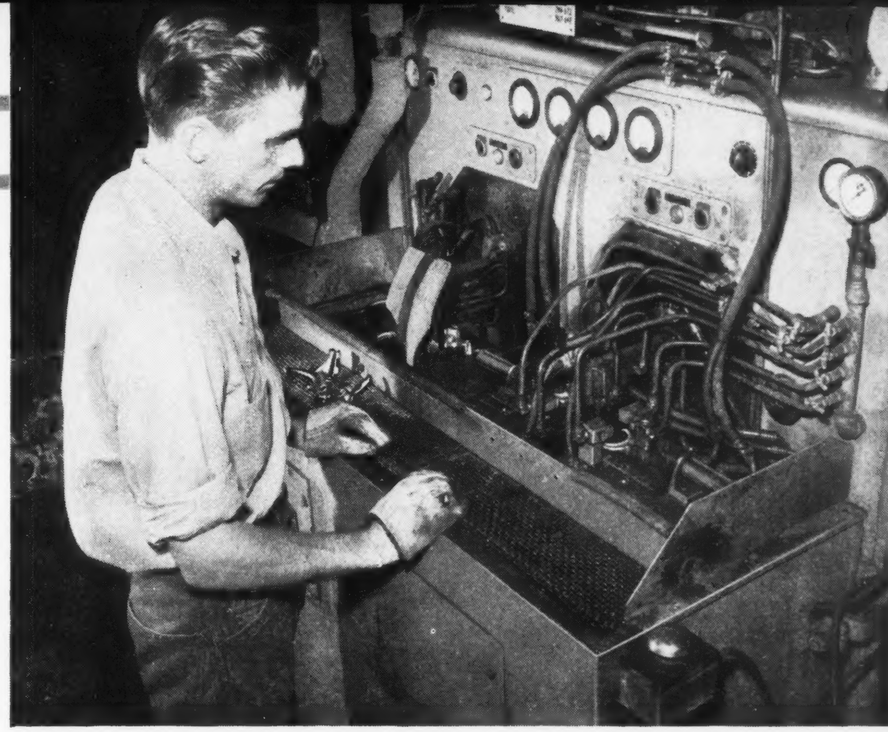


Fig. 3. Shifter forks are selectively hardened without distortion at a rate of 180 pairs per hour on the 20-K.W., 450,000-cycle induction heater here shown

The rails to be hardened roll down the magazine, seen at the left, and drop on the conveyor, one at a time, being released by solenoid-operated selectors that are synchronized with the rails leaving the machine. The rails are propelled forward by a positive type chain feeder and rotated about their own axis by power-driven, hardened steel rollers. As the rails pass through the inductor coil, the required surfaces are heated and immediately spray-quenched by multiple jets of water from a quench ring. The rate of feed of the rails through the machine is 0.69 inch per second. In order to avoid quench cracks, the temperature of the water is maintained at between 95 and 100 degrees F. by an automatic water regulating valve controlling the flow and mixing of hot and cold water.

A major advantage of this "scanning" method of progressive, selective hardening is that a relatively small power input is required, compared with that necessary for heating all surfaces of the part simultaneously. In addition to the greater production obtained by induction hardening, the previous method of heat-treating by carburizing and then cyaniding the ends, necessitating straightening, shot-blasting, and tempering, has been eliminated.

Complex-shaped shifter forks, forged from AISI 1045 steel, are selectively surface hardened at the rate of 180 pairs per hour by means of the induction heating set-up shown in Fig. 3. A 20-K.W., 450,000-cycle, two-station induction heater is employed for this operation, which results in a hardness of from 55 to 60 Rockwell C.

Two forks are located on pins at the first station of the machine. At this station, pads on the forks are heated and quenched in an eight-second cycle. The forks are then transferred to the second station, where slots in the forks are hardened in a ten-second cycle. Warpage of the forks has been reduced by this process, and the amount

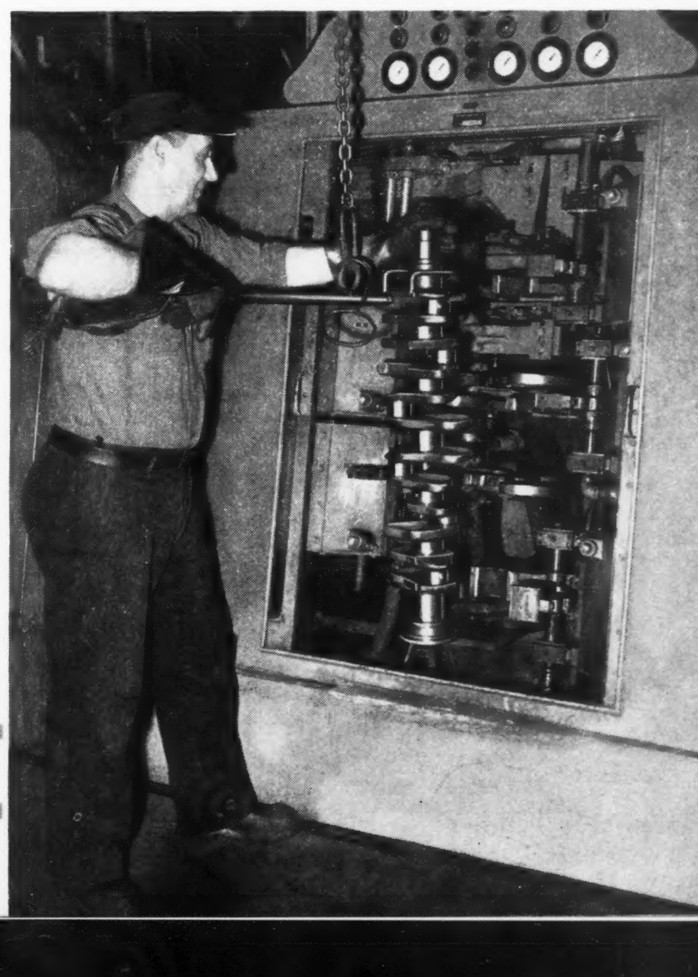


Fig. 4. Placing a seven-bearing, six-throw crankshaft in the vertical fixture of a 200-K.W. induction heating machine, preparatory to hardening five of its bearing surfaces

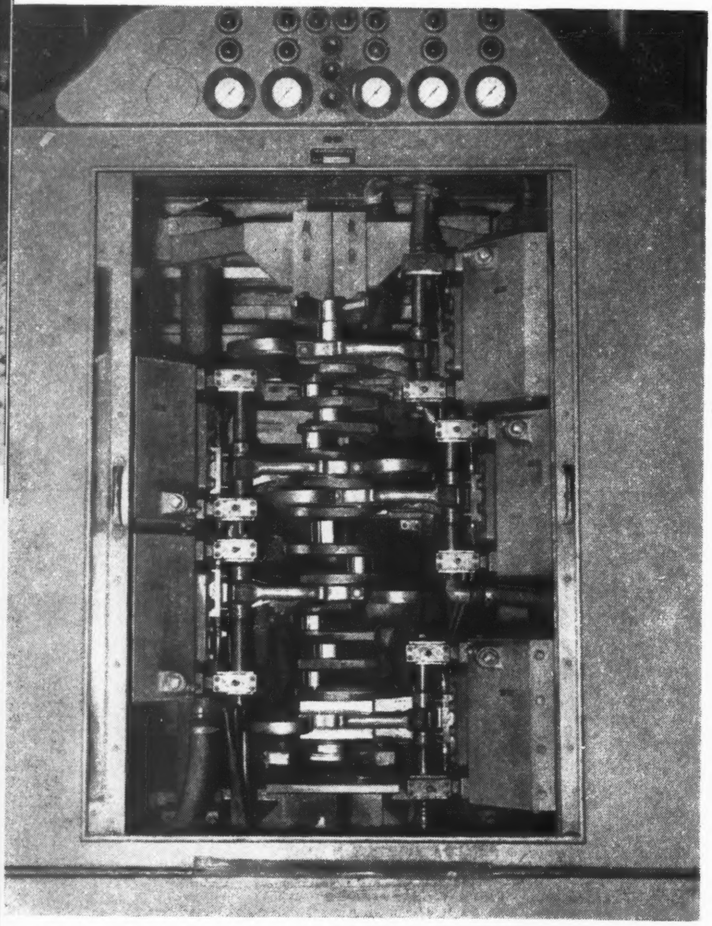


Fig. 5. Air-actuated clamps hold the split inductor blocks in place, adjacent to the crankshaft bearing surfaces to be hardened, during the automatic cycle

of straightening previously required after cyaniding has been greatly decreased.

Crankshaft pin and main bearing surfaces on heavy-duty Dodge truck crankshafts are hardened in a series of three induction heating machines operating at a frequency of 3000 cycles per second. Specified hardnesses and contour of the hardness pattern are consistently obtained with this equipment. The main bearing and connecting-rod bearing surfaces are hardened to within 1/8 inch of the fillets, leaving the core of the shaft tough and ductile. Maximum depth of hardness is obtained at the center of the bearing surfaces, where it is most desirable.

The crankshafts are progressively moved from one machine to the next, four of the bearing surfaces being hardened in each of two machines and five surfaces in the third machine. Each vertical unit has an output of 200 K.W. at a frequency of 3000 cycles. The seven-bearing, six-throw crankshafts, forged from S A E 1050 steel, are placed manually in a vertical position on the fixture, as seen in Fig. 4. Air-actuated clamps hold the split inductor blocks in place adjacent to the surfaces to be hardened during the automatic cycle, Fig. 5.

Water, passing through orifices in the inductor blocks, instantly quenches the surfaces when they reach the desired temperature. An 11 1/2-second cycle is required to harden the rear main bearing surface, while 5 3/10 seconds are required for each of the remaining surfaces. Wooden plugs are placed in the drilled holes on the bearing surfaces previous to hardening to prevent the formation of quench cracks. Crankshafts are subsequently tempered, resulting in a hardness on the bearing surfaces of 55 Rockwell C and a maximum hardness depth of 1/8 inch. A production of eight crankshafts per hour can be obtained with only one operator.

Who Will Pay for Research?

IN Government circles, it has become popular to decry big business corporations and to stigmatize them in the eyes of the public by calling them monopolies, concentrations of economic power, or selfish interests. Some of the largest companies are being sued by the Department of Justice with a view to partial dissolution, and it is anticipated that if these suits are successful, similar ones will be instituted against other corporations.

Undoubtedly some companies have been guilty of questionable business practices, especially in the early days of their expansion, and wrongdoings are not to be justified. At the same time, "trust-busting" should not be "witch-hunting" for mere political advantage. The fact should not be overlooked that there is at least one tremendous advantage to the national economy which can be obtained only through the use of the financial resources available to large business enterprises. This advantage is the ability to organize and maintain extensive research projects.

For example, basic research leading to the development of nylon was started by duPont in 1928, but it was not until twelve years later that the first pound of nylon was produced in a commercial unit. In the intervening period, the company expended approximately $27,000,000 on a project that turned out to be one of the concern's greatest successes but that, at the time, had been one of its greatest gambles.

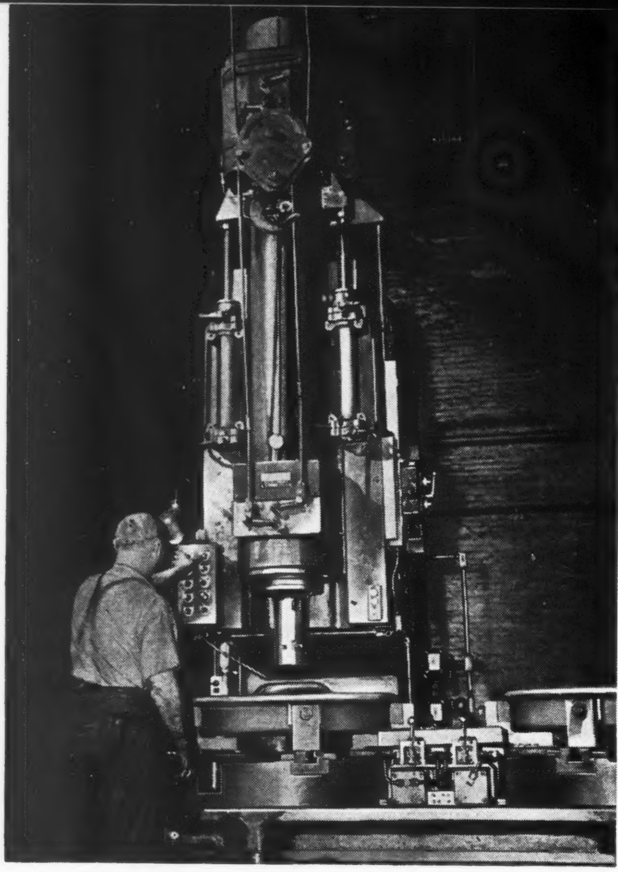
Before World War I, the United States had practically no dyestuffs industry. We were dependent on Germany even for the dyes used in printing our postage stamps and money. With the outbreak of war, several companies pioneered in the manufacture of dyestuffs in this country. It took duPont eighteen years and an expenditure of $43,000,000 before profits offset the losses of that venture.

In the metal-working field, it has been principally the automobile companies that have been able to supply the money necessary for new developments. The high-production machining methods and other short-cuts devised by that industry, such as are featured in this issue, have been of immeasurable benefit to practically all types of metal-working plants, both large and small. The money spent by the big automobile companies in research has brought numerous luxury items within the financial reach of practically everyone. Many of the revolutionary developments that helped to win World War II were produced in the laboratories and research departments of private concerns.

Without the assistance of companies big enough to provide great sums of money, research would be stifled—and it is research that has made America the leading industrial nation of the world, with all its material and cultural advantages. Certainly the Government could not afford to provide research facilities on the scale of private industry.

Charles O. Herb

EDITOR



How to Estimate on Boring

Fourth in a Series of Articles on Estimating Machining Costs in the Job Shop, Covering All the Basic Types of Machine Tools

THERE are several types of boring mills, some of which are designed for special-purpose work. This article, however, will describe the procedure for applying an estimating plan to conventional boring mills.

In laying out the estimating procedure, a basic set of machining conditions is selected and arranged in simple chart form. Thus, by making adjustments according to the actual conditions for any given job, detailed calculations for various types and hardnesses of materials, different cutters, and various set-up conditions are eliminated. In this way, the time required for estimating is considerably reduced.

Obviously, if each cut or operation were estimated by individual calculations based upon all of these considerations, a much longer time would be required. By using one set of basic conditions, it is economical to break down the required machining operations, so as to estimate each cut or operation separately, and establish not only the time estimate, but also a predetermined machining sequence. In some shops, this can be of assistance to the supervisors in planning their work schedules, and may provide a method by which customer delivery schedules can be established.

While this article is mainly concerned with boring operations, a considerable amount of milling is done on horizontal boring machines. For estimating time required for milling work, reference may be made to the previous article on this subject, published in the September number. It must be kept in mind when estimating time for work on this machine tool that the speeds and feeds used will be governed by the distance the bar is extended from the head. When the cutter is close to the head, the set-up is rigid, and the greater the distance the cutter is from the head, the weaker the set-up will be. Also, the age and condition of the machine are factors that must be taken into consideration in determining speeds and feeds.

The problem of lack of rigidity in the set-up also exists in the boring operation when the outboard bearing cannot be used. For example, a 3-inch bar mill will require a finer feed than a 4-inch bar mill when boring a certain diameter and length. Therefore, no exact formula can be prescribed for all conditions.

Machine specification charts should be made for all machine tools to simplify the estimator's work when a job is scheduled for a certain machine. By having this data available for reference, the estimator does not need to check with the shop, thus saving not only his own time, but the shop supervisor's time as well.

Table 1 is typical of such charts. This shows the machine specifications, speeds, and feeds for three different horizontal boring mills. To facilitate the estimating of time required for boring operations, a chart similar to Table 2 will also be found useful. This table, based upon a selected feed and speed, gives the time required to bore holes of various lengths and diameters. To use this data in determining the actual time for a given job, it is necessary to multiply the charted time by factors that are based upon the actual speeds and feeds used. In this case, a basic feed of 0.003 inch per revolution and a speed of 50 feet per minute were selected. With any feed and speed chosen, a delay allowance factor must be used in calculating the tabulated time for an operation.

As described in the previous article, delay allowances of 20 per cent were added to the base time for horizontal milling. However, boring

Drilling and Boring Costs

Mills

By HERBERT W. BROWN
Management Consultant

operations require not only grinding of the tools but also resetting them for each cut, which in most instances must be done within very close tolerances. Measuring time, therefore, necessitates greater allowance on boring operations than on milling work. Consequently, an allowance of 37 1/2 per cent is added to the base time for boring operations.

The time, as given in Table 2, is determined by multiplying the length of bore in inches by the delay allowance factor and dividing this product by the speed in revolutions per minute multiplied by the feed in inches per revolution.

Example—If the length of bore is 10 inches, the diameter is 5 inches, the speed in revolutions per minute is 38.2 (using a basic cutting speed of 50 feet per minute for a 5-inch diameter bore) the basic feed is 0.003 inch per revolution, and the delay allowance is 37 1/2 per cent, (giving a delay allowance factor of 1.375), the tabulated time required per cut is:

$$\frac{10.0 \times 1.375}{38.2 \times 0.003} = 119.98 \text{ minutes}$$

To convert this tabulated time data to the actual time required for a given job, the basic feed and speed used in setting up Table 2 are divided by the feed and speed employed on a given boring operation. Recommended speeds and feeds for various materials and hole diameters are given in Table 3, along with conversion factors that may be applied in conjunction with Table 2.

The following example will serve to illustrate the manner in which these conversion factors are calculated:

Example—The basic speed used in Table 2 is 50 feet per minute. In a boring operation on a carbon steel casting, the recommended cutting speed (Table 3) is, say, 40 feet per minute. Then the cutting speed conversion factor to be used with Table 2 for this particular operation is $50 \div 40 = 1.25$.

The same principle is applied in determining the feed conversion factor. The feed used in setting up Table 2 was 0.003 inch per revolution. Assuming that the feed employed in an actual job was 0.014 inch per revolution, the conversion factor would be: $0.003 \div 0.014 = 0.214$.

Both of these factors are applied to the data given in Table 2 by first multiplying the charted time for a given diameter and length of bore by the cutting speed factor, and then multiplying this product by the feed factor. The result is the estimated time for one cut. Obviously, the number of cuts must be taken into consideration in order to arrive at the total time required to complete an actual boring operation.

Example—Assume that the material to be bored is medium cast iron and that the bore is 4 inches in diameter and 14 inches long. The recommended cutting speed (from Table 3) is 70 feet per minute, and the recommended feed is 0.017 inch per revolution. The time given in Table 2 for a bore 4 inches in diameter by 10 inches long is 95.89 minutes. To this must be added the time for a 4-inch long bore of the same diameter (as the specified bore is 14 inches long),

Table 1. Typical Horizontal Boring Mill Specifications

Machine A		Machine B		Machine C	
Table travel, 42″ Cross travel, 37″ Vertical travel, 33″ Spindle travel, 20″ Bar diameter, 3″ Table size, 42 × 58″		Table travel, 64″ Cross travel, 36″ Vertical travel, 30″ Spindle travel, 25″ Bar diameter, 4″ Table size, 36 × 64″		Table travel, 64″ Cross travel, 40″ Vertical travel, 50″ Spindle travel, 30″ Bar diameter, 4″ Table size, 48 × 74″	
Spindle Speeds, R.P.M.	Feeds, Inches per Revolution	Spindle Speeds, R.P.M.	Feeds, Inches per Revolution	Spindle Speeds, R.P.M.	Feeds, Inches per Revolution
16	0.003	12	0.0025	9	0.003
23	0.004	21	0.0043	16	0.0045
32	0.007	35	0.0072	28	0.007
44	0.010	43	0.0099	48	0.010
	0.012	48	0.0129	52	0.012
63	0.014	60	0.0144	63	0.014
	0.017	70	0.0173	71	0.017
	0.024	74	0.0236	76	0.024
87	0.029	94	0.0288	90	0.029
120	0.040	127	0.0422	125	0.036
	0.052	142	0.0503	150	.....
170	0.070	175	0.0695	185	.....
	.....	205	0.0846	195	0.083
	0.105	218	0.0945	220	0.100
240	0.126	252	......	235	0.125
325	0.175	340	0.1653	380	0.166
	0.182	...	......	410	0.200
470	.....	515	......	500	0.225
650	.....	742	0.2781	715	.....
	0.315	...	......	870	0.333
	0.438	1000	......	1025	0.400
	.....	....	0.490	1250	0.500
				1520	0.666

Table 2. Typical Rough-Boring Time Chart
(Horizontal Boring Mills)

Diameter of Bore, Inches	Length of Bore, Inches									
	1	2	3	4	5	10	15	20	25	30
	Time per Cut, Minutes*									
1	2.40	4.80	7.20	9.60	12.00	24.00	36.00	48.00	60.00	72.00
1 1/2	3.61	7.22	10.83	14.44	18.04	36.09	54.13	72.18	90.22	108.27
2	4.80	9.60	14.40	19.20	24.00	48.00	72.00	96.00	119.98	143.98
2 1/2	6.01	12.01	18.02	24.03	30.03	60.07	90.10	120.14	150.17	180.21
3	7.20	14.39	21.59	28.78	35.98	71.95	107.93	143.90	179.88	215.86
3 1/2	8.41	16.82	25.23	33.64	42.05	84.10	126.15	168.20	210.24	252.29
4	9.59	19.18	28.77	38.35	47.94	95.89	143.83	191.77	239.71	287.66
4 1/2	10.81	21.62	34.43	43.24	54.05	108.10	162.15	216.19	270.24	324.29
5	12.00	24.00	35.99	47.99	59.99	119.98	179.97	239.97	299.96	359.95
5 1/2	13.21	26.42	39.63	52.83	66.04	132.08	198.13	264.17	330.21	396.25
6	14.41	28.83	43.24	57.65	72.06	144.13	216.19	288.26	360.32	432.39
6 1/2	15.59	31.18	46.77	62.36	77.95	155.90	233.84	311.79	389.74	467.69
7	16.79	33.58	50.37	67.16	83.94	167.89	251.83	335.78	419.72	503.66
7 1/2	18.04	36.09	54.13	72.18	90.22	180.45	270.67	360.89	451.12	541.34
8	19.18	38.35	57.53	76.71	95.89	191.77	287.66	383.54	479.43	575.31
8 1/2	20.37	40.74	61.11	81.48	101.85	203.70	305.56	407.41	509.26	611.11
9	21.62	43.24	64.86	86.48	108.10	216.19	324.29	432.39	540.49	648.58
9 1/2	22.80	45.61	68.41	91.21	114.01	228.03	342.04	456.05	570.07	684.08
10	24.00	47.99	71.99	95.99	119.98	239.97	359.95	479.93	599.91	719.90
10 1/2	25.18	50.37	75.55	100.73	125.92	251.83	377.75	503.66	629.58	755.48
11	26.34	52.68	79.02	105.36	131.70	263.41	395.11	526.82	658.52	790.23
11 1/2	27.61	55.22	82.83	110.44	138.05	276.10	414.16	552.21	690.26	828.31
12	28.83	57.65	86.48	115.30	144.13	288.26	432.39	576.52	720.65	864.78

*Time is based on common feed of 0.003 inch per revolution and cutting speed of 50 feet per minute.

Note: In the figures given, the following allowances have been included: Delays, 10 per cent; tool grinding and setting, 15 per cent; measuring, 7 1/2 per cent; and other essential interruptions, 5 per cent, making a total of 37 1/2 per cent.

which is 38.35 minutes. Thus the total tabulated time is $95.89 + 38.35 = 134.24$ minutes. (It will be noted that the tabulated time for any length of bore can be obtained by multiplying the desired length by the charted time for a 1-inch length bore of the given diameter.)

The resulting charted time is then multiplied by the conversion factor for a cutting speed of 70 feet per minute (0.714, Table 3), after which this product is multiplied by the conversion factor for a feed of 0.017 inch per revolution (0.177, Table 3) as follows:

$$134.2 \times 0.714 \times 0.177 = 16.9$$

or 17 minutes actual time per cut.

This result must now be multiplied by the number of estimated cuts to obtain the total estimated time required to bore one hole. For purposes of illustration, Table 2 is set up to show bore lengths from 1 to 5 inches varying in increments of 1 inch, and from 5 to 30 inches varying in increments of 5 inches.

The drilling time chart, Table 4, based upon a feed of 0.003 inch per revolution and a cutting speed of 50 feet per minute, is similar to the boring time chart with the exception that an additional delay allowance must be made for various depths of hole, since the problem of chip removal becomes greater and more time consuming as the depth of the hole increases.

Ordinarily such allowances start at twice the diameter of the drilled hole; however, in Table 4, this additional delay allowance for chip removal is applied only to the drilling of holes 2 inches and more in depth. It has been proved by experience that approximately 6 per cent per inch of depth is sufficient for this allowance, although this may vary in different shops due to individual operating practices.

It has been observed that the speeds and feeds actually used in drilling are usually lower than accepted standards, and this is largely caused by improperly ground drills. For this reason, it is essential to take into consideration the condition of the drills used, just as it is necessary to take into account other operating conditions.

The time tabulated in Table 4 for different depths of holes applies only to the depth shown; in other words, the time for two or more charted lengths cannot be added together to determine the time required for deeper holes, because the chip removal allowance is cumulative. For example, to obtain the time needed to drill a hole 2 7/8 inches in diameter by 13 inches deep, it would not be possible to add the time for a 1-inch deep hole of that diameter to the time for a 12-inch deep hole. This would amount to about 127 minutes, whereas the correct time would be 135 minutes.

To calculate the tabulated data given in Table 4,

Table 3. Recommended Boring Speeds and Feeds with Estimating Time Conversion Factors

(High-Speed Steel Cutters)

Material	Recommended Speeds, Feet per Minute	Time Estimating Conversion Factors*	Diameter of Bore, Inches	Recommended Feeds, Inches per Revolution	Time Estimating Conversion Factors*
Cast Iron					
Soft	90–100	0.555–0.500	1 to 1 1/2	0.006–0.008	0.500–0.375
Medium	70– 80	0.714–0.625	1 1/2 to 2	0.010–0.012	0.300–0.250
Hard	50– 60	1.000–0.833	2 to 3	0.014–0.017	0.215–0.177
Malleable	60– 70	0.833–0.714	3 to 5	0.017–0.024	0.177–0.125
Finishing	70–100	0.714–0.500	5 to 8	0.024–0.036	0.125–0.083
Steel			8 to 10	0.029–0.036	0.104–0.083
Hot-Rolled Machinery	90–110	0.555–0.455	10 to 12	0.036–0.050	0.083–0.060
Cold-Drawn, Low-Carbon	80–100	0.625–0.500			
Castings, Carbon	40– 50	1.250–1.000			
Castings, Alloy, Free-Machining	50– 60	1.000–0.833			
Castings, Alloy, Tough-Machining	35– 50	1.428–1.000			
Annealed Tool Steel	40– 50	1.250–1.000			
Finishing	40–100	1.250–0.500			
Non-Ferrous					
Brass	200–300	0.250–0.166			
Bronze, Medium	150–250	0.333–0.200			
Bronze, Manganese	80–100	0.625–0.500			
Aluminum	300–500	0.166–0.100			

*These conversion factors are used with the tabulated data given in Table 2 to convert charted time to actual time, based upon the use of recommended speeds and feeds.

the depth of hole in inches is multiplied by the delay allowance factor, after which this product is divided by the speed in revolutions per minute multiplied by the feed in inches per revolution. The result is then multiplied by the hole-depth chip-removal allowance factor of 6 per cent per inch of depth.

Example—If the depth of the hole is 7 inches; the delay allowance factor is 1.20; the speed 50 feet per minute; the drill diameter 1 5/8 inches; and the feed 0.003 inch per revolution, the base time is calculated as follows: First determine the speed in revolutions per minute for a 1 5/8-inch diameter drill, which is approximately 117 revolutions per minute in this case. Then:

$$\frac{7 \times 1.20}{117 \times 0.003} = 23.93 \text{ minutes}$$

As the hole-depth allowance is 6 per cent per inch of depth, beginning at 2 inches, the allowance for a 7-inch deep hole, in the above example, will amount to 36 per cent. This is added to the base time of 23.93 minutes, resulting in a total

Table 4. Typical Rough-Drilling Time Chart

(Horizontal Boring Mill)

Diameter of Hole, Inches	Depth of Hole, Inches											
	1	2	3	4	5	6	7	8	9	10	11	12
	Time per Cut, Minutes*											
7/16	0.92	1.94	3.08	4.32	5.67	7.14	8.71					
9/16	1.18	2.49	3.95	5.55	7.29	9.18	11.20	13.37				
11/16	1.47	3.11	4.92	6.92	9.08	11.43	13.95	16.64	19.52			
7/8	1.83	3.87	6.14	8.62	11.94	15.03	18.34	20.75	24.33	28.13		
1 1/8	2.35	4.99	7.91	11.11	14.59	18.35	22.40	26.73	31.34	36.23	41.41	
1 3/8	2.88	6.10	9.67	13.58	17.84	22.45	27.40	32.69	38.33	44.32	50.65	57.32
1 5/8	3.42	7.66	11.49	16.14	21.20	26.67	32.55	38.84	45.54	52.65	60.17	68.10
1 7/8	3.92	8.31	13.18	18.51	24.31	30.59	37.33	44.55	52.24	60.39	69.02	78.12
2 1/8	4.44	9.42	14.93	20.98	27.56	34.67	42.30	50.49	59.20	68.44	78.22	88.53
2 3/8	4.97	10.53	16.70	23.45	30.81	38.76	47.30	56.45	66.19	76.52	87.45	98.98
2 5/8	5.52	11.70	18.54	26.04	34.21	43.03	52.52	62.68	73.49	84.96	97.10	109.90
2 7/8	6.06	12.85	20.36	28.61	37.58	47.27	57.70	68.85	80.73	93.33	106.67	120.73

*Time based on common feed of 0.003 inch per revolution and speed of 50 feet per minute.

Note: In the figures given, the following allowances have been included: Delays, 10 per cent; drill grinding, 5 per cent; and other essential interruptions, 5 per cent, making a total of 20 per cent. An additional allowance of 6 per cent per inch of hole depth, beginning at 2 inches, has been included in the calculations used to obtain this data.

Table 5. Recommended Drilling Speeds and Feeds with Estimating Time Conversion Factors
(High-Speed Steel Drills)

Material	Recommended Speeds, Feet per Minute	Time Estimating Conversion Factors*	Diameter of Drill, Inches	Recommended Feeds, Inches per Revolution	Time Estimating Conversion Factors*
Cast Iron					
Soft	100–110	0.500–0.455	7/16	0.006–0.008	0.500–0.375
Medium	70– 90	0.714–0.555	9/16	0.008–0.010	0.375–0.300
Hard	50– 70	1.000–0.714	11/16	0.010–0.012	0.300–0.250
Malleable	75– 90	0.667–0.555	7/8	0.012–0.014	0.250–0.215
Steel					
Hot-Rolled Machinery	100–120	0.500–0.417	1 1/8	0.012–0.014	0.250–0.215
Cold-Drawn, Low-Carbon	80–100	0.625–0.500	1 3/8	0.014–0.017	0.215–0.177
Castings, Carbon	40– 50	1.250–1.000	1 5/8	0.014–0.017	0.215–0.177
Castings, Alloy, Free-Machining	50– 70	1.000–0.714	1 7/8	0.014–0.017	0.215–0.177
Castings, Alloy, Tough-Machining	35– 50	1.428–1.000	2 1/8	0.017–0.024	0.177–0.125
Annealed Tool Steel	40– 50	1.250–1.000	2 3/8	0.017–0.024	0.177–0.125
Non-Ferrous					
Brass	250–300	0.200–0.167	2 5/8	0.017–0 024	0.177–0.125
Bronze, Medium	200–250	0.250–0.200	2 7/8	0.017–0.024	0.177–0.125
Bronze, Manganese	80–100	0.625–0.500			
Aluminum	350–500	0.143–0.100			

*These conversion factors are used with the tabulated data given in Table 4 to convert charted time to actual time, based upon the use of recommended speeds and feeds.

charted time of 32.55 minutes. (23.93 $\times$ 1.36 = 32.55.)

To obtain the time required for a given job, the tabulated time shown in Table 4, including allowance for chip removal delays, is multiplied by the ratios between the basic speed and feed used in setting up the table and the speed and feed actually employed. Table 5 shows some of these conversion factors worked out for recommended speeds and feeds for various materials and drill sizes.

In core-drilling, the feeds given should be increased to the next higher feed or even more. For example, in drilling a 1 3/8- to 2 1/8-inch hole, it may be possible to use a feed of 0.024 inch per revolution instead of 0.014 or 0.017 inch per revolution, depending upon the material and its hardness. The recommended feeds shown in Table 5 have purposely been made lower than those that normally can be used.

In a subsequent article, the procedure for estimating lathe work will be described.

* * *

Unified Screw Thread Recommended at Paris Meeting

Delegates from fifteen of the eighteen countries represented at the recent Paris meeting of the International Standardization Organization voted to recommend the Unified Anglo-American Screw Thread to their national standardizing bodies as the common profile for the metric and inch systems of screw threads.

Diamond Tools Suitable for Machining Powdered-Metal Bearings

E. J. Weller, in his article "Machining Sintered Powdered-Metal Bearing Materials," which appeared in June MACHINERY, mentioned that sharp tools were absolutely necessary for the satisfactory machining of porous iron and bronze powdered-metal bearings after they had been sintered. The author stated that either high-speed steel or cemented-carbide tools can be employed for this purpose, but did not mention diamond tools. The standard practice of one manufacturer in Europe is to finish all bearings of this kind with diamond tools, as they permit attainment of an exceptionally smooth surface.

London, England P. GRODZINSKI

* * *

French Steel Industry Buys American Electrical Equipment

An order for $9,500,000 worth of electrical steel equipment has been placed with the Westinghouse Electric International Co. by the Sollac Association (Societe Lorraine de Laminage Continu), which is an association of nine French steel firms. These mills will have capacity for processing a minimum of 850,000 tons of ingot steel annually into light sheet steel and tin plate.

* * *

Highway users paid $3,442,000,000 in special Federal, state, and city taxes in 1948.

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

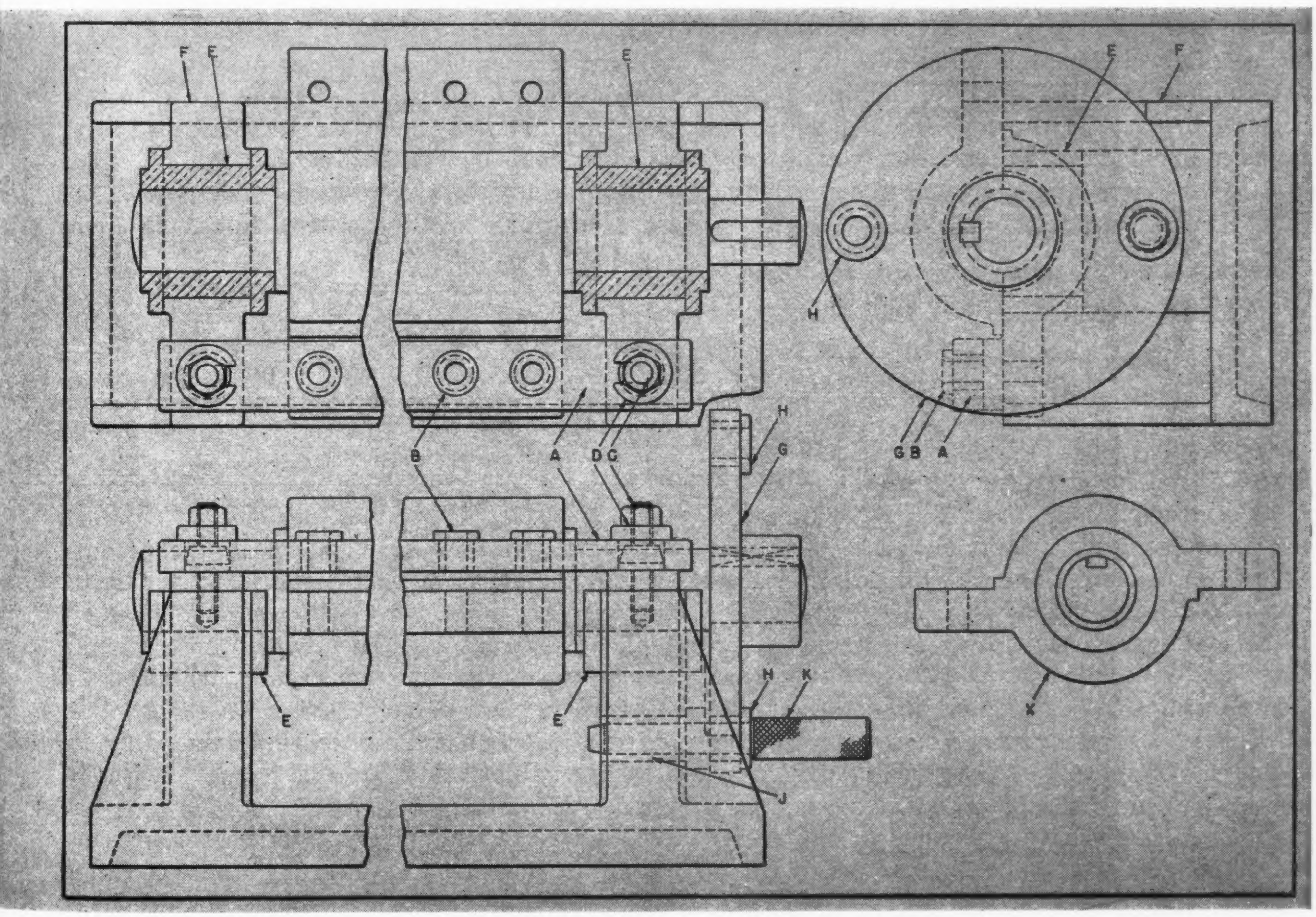
Indexing Fixture with Quickly Removable Bushing Bar

By HAROLD E. MURPHEY, Westerly, R. I.

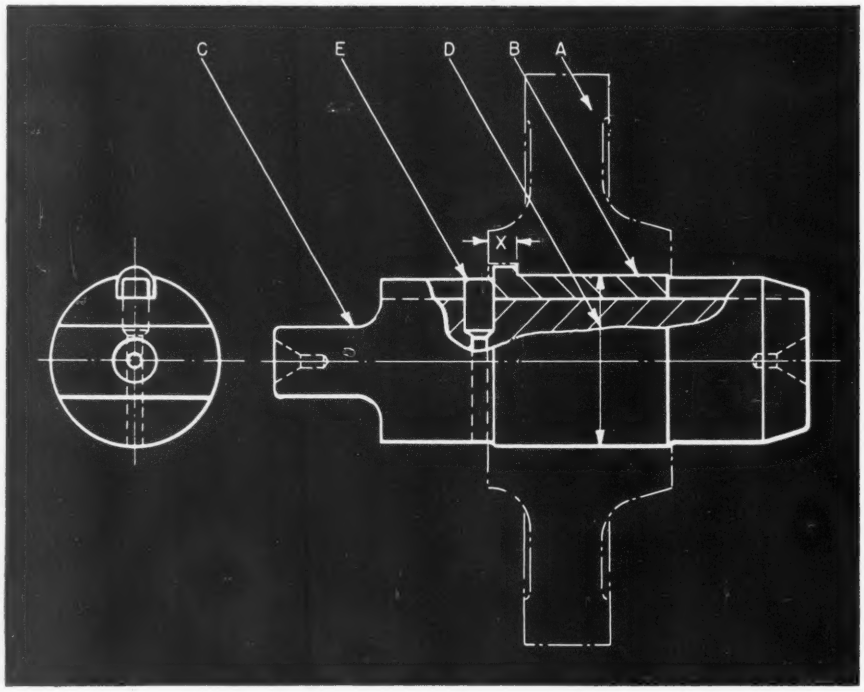
The indexing fixture illustrated was designed for drilling a series of 0.421-inch diameter holes in two rows 180 degrees apart. The work-pieces are printing press cutter stocks and the drilled holes are later tapped for use in assembling cutter blades.

The special feature of this fixture is a bushing bar that can be quickly removed after each row of holes in the work *X* is drilled. The bar *A*, containing nine drill bushings *B*, extends along one side of the fixture, and is secured at each end over the tapered section of threaded studs *C* by slip collars *D* and suitable hexagon-head nuts. The bushing bar is located by holes in the bar, into which the straight portion of studs *C* fits. As this part of the studs is only 1/8 inch long, the bar can be quickly removed over the hexagon-head nuts after the nuts are loosened and the slip collars taken off.

Shafts projecting from each end of the work are supported in journal boxes *E* in the base *F* of the fixture. An indexing plate *G* at one end of the fixture fits over the shaft at that end and is locked by a key and keyway so that the work is rotated when the plate is turned. Two bushings *H*, 180 degrees apart in the plate, are used to position the work for drilling the two rows of holes. One bushing *H* is brought into alignment with a locating bushing *J* in the base, and an index-pin *K* inserted through the holes in the



Indexing fixture that firmly supports long work for accurately drilling two rows of holes 180 degrees apart



Special arbor and key for holding a gear blank, the bore of which cannot be keyed, during machining operation

two bushings, after which one row of holes is drilled.

When this drilling operation is completed, the two hexagon-head nuts are loosened, the slip collars taken off, and the bushing bar removed. The index-pin is then placed in the other bushing *H*, and the indexing plate is turned until that bushing is brought into alignment with bushing *J*. This positions the work for drilling the second row of holes, after which the bushing bar is replaced and the drilling operation completed.

Special Arbor and Key for Holding Gear Blank while Machining

By STANLEY R. WELLING, Racine, Wis.

The bore of the gear blank *A* shown in the accompanying illustration is to serve as the outer race for a roller bearing, and therefore cannot have a keyway in it. This design prohibits the use of conventional drivers on work-holding arbors when machining the gear blank. An attempt was made to broach the hole to size and press the blank on a plain arbor. With this method, however, the work slipped when heavy cuts were taken at high speeds with carbide tools.

To solve this problem, a recess was drilled to a depth *X* in one side of the gear blank, using a jig designed for the job. The recess serves as a seat for the work-driving shoulder on special key *B*. Arbor *C* was cylindrically ground on diameter *D* to a press fit in the bore of the gear blank. A keyway was milled and ground in the arbor to provide a slip fit for key *B*. Stop-pin *E*, pressed into a hole drilled in the arbor, projects into the keyway to provide a positive stop for the gear blank when it is pressed on the arbor. Accurate location is thus insured, since the work-piece will always be in the same position relative to the headstock center.

Sharp corners on the key and keyway were stoned smooth, so that they would not mar the gear blank bore. The arbor was machined to a smaller diameter at the right-hand end and chamfered to facilitate loading. The portion of the gear blank that is recessed is cut off in a subsequent operation.

Simple Diaphragm Pump for Removal of Liquids

By EDWIN F. MOSTHAF, Consulting Engineer
Orange, N. J.

The diaphragm pump shown in the accompanying illustration was designed to facilitate the transfer or removal of water and other liquids from large containers where conventional emptying equipment is not readily available. It offers a simple means of saving time and labor in removing liquids from large drums or other containers that are awkward to move without expensive handling devices.

This type of pump is especially useful for temporary or emergency applications where coolants are required at machinery that is not provided with conventional pumping equipment. As it

contains no precision working parts that might be affected by foreign matter and dirt, it can be safely applied for draining the most contaminated tanks without danger of clogging.

One of its principal advantages is simplicity of design. As there are no accurately assembled parts, precise toolmaking is not required, and, therefore, the unit can be made quickly and cheaply in any shop without recourse to skilled help. The design is based on one of the oldest and best known hydraulic principles. This is the application of a diaphragm actuated by a rod to create suction and pressure through the use of simple flap valves.

Reference to the illustration shows that lifting the actuating rod A raises the diaphragm B, producing a suction stroke over the lower part of chamber C. The vacuum thus created causes that portion of the flap valve E which is directly over the inlet port F to rise, admitting into the chamber the liquid that has been drawn upward as a result of the suction. Depressing the rod closes the flap valve over the inlet port and opens that portion of it which is over the outlet port G. This forces the liquid out of the chamber and through the outlet port under pressure.

As a guide for determining the size of pump required for any given application, it should be noted that the volume of liquid displaced by the diaphragm at each stroke of the rod equals the volume of the truncated cones formed by the diaphragm in the suction and pressure positions.

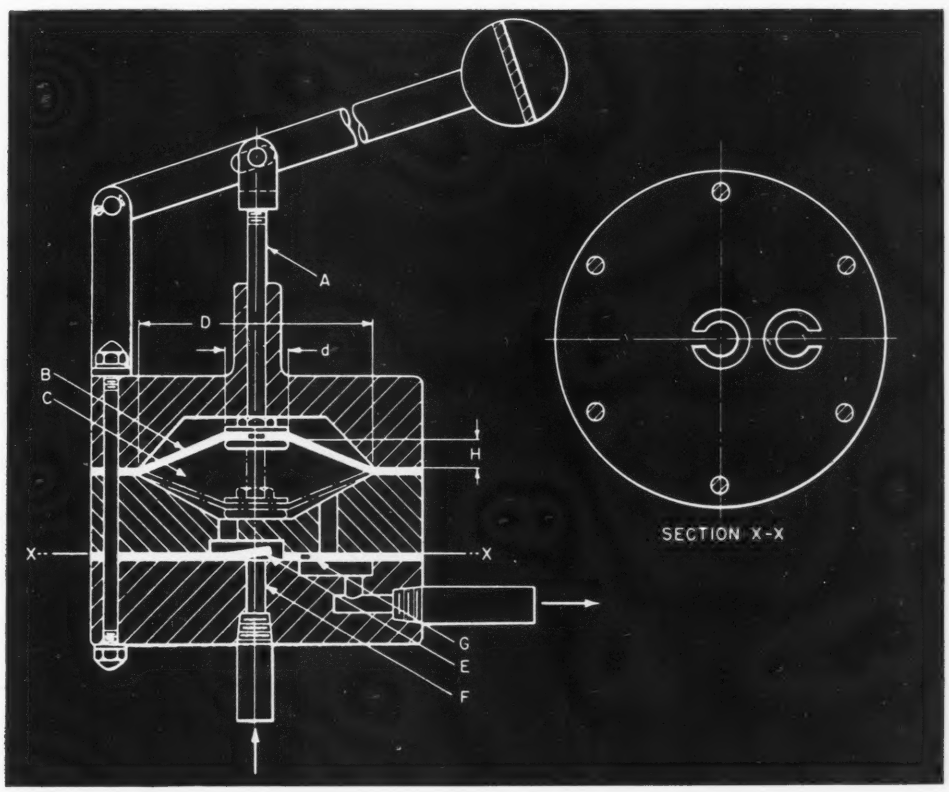
For example, if diameter D of the diaphragm is 3.250 inches, diameter d is 0.500 inch, and height H equals 0.375 inch, then, using the formula for finding the volume of truncated cones,

$$V = 0.2618H\ (D^2 + Dd + d^2) =$$
$$0.2618 \times 0.375 \times (10.562 + 1.625 + 0.250) =$$
$$1.220 \text{ cubic inches}$$

This is the volume displaced in one-half stroke of the diaphragm. Therefore, at 100 per cent efficiency, the total volume of liquid displaced with each discharge stroke will be $2 \times 1.220 = 2.440$ cubic inches. Assuming that the efficiency of the pump is 80 per cent, the effective volume of liquid will be about 1.952 cubic inches. At 120 strokes per minute, a pump of these dimensions will deliver about one gallon of water a minute.

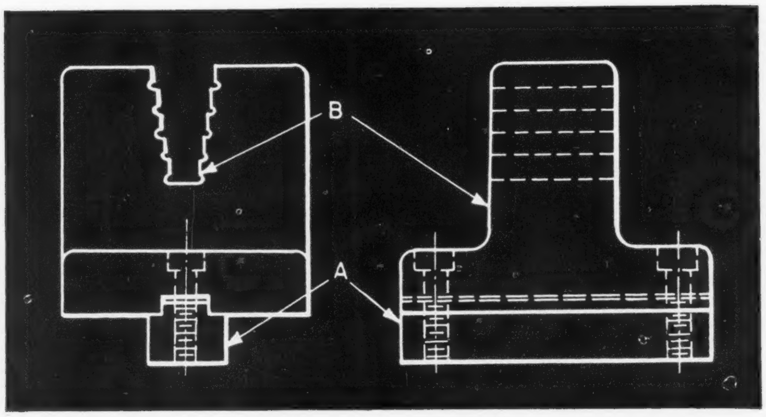
In order to determine the length and size of inlet pipe required for any given set of conditions, the suction lift obtained may be considered, for practical purposes, to be proportional to the effective volume of the vacuum created and the area of the inlet pipe used. Where H equals the height of the lift, V equals the volume of effective vacuum created by the diaphragm, and a equals the area of the pipe, for a 1/8-inch diameter pipe with a cross-sectional area of 0.06 square inch and for a pump with an effective volume of vacuum equal to 1.952 cubic inches, we have:

$$H = \frac{V}{a} = \frac{1.952}{0.06} = 32\ 1/2 \text{ inches}$$



Simple diaphragm pump for removing liquids from large containers

Centralizing tool for aligning milling cutter with a T-slot in the milling machine table. The tongue (A) is placed in T-slot, after which table is adjusted until milling cutter enters correct slot in top of tool body (B)



The result obtained by this formula represents the lift for each complete stroke.

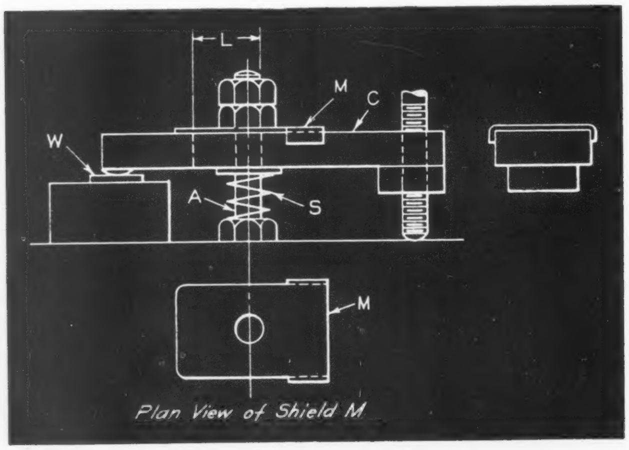
The materials used in making the pump largely depend upon the liquids to be handled, but for general purposes any metal is suitable for the body, and ordinary inner-tube rubber may be used for the diaphragm and the flap valve. For many applications, well shellacked hard wood has been used successfully for the pump body.

It can be seen from the illustration that the pump is made in three sections, securely held together by a number of tie-bolts. For applications where it is desirable to have the pump operate automatically, the reciprocating arm can be linked to a motor-driven cam.

Centralizing Tool that Simplifies Milling Cutter Set-Up

By J. HOMEWOOD, Ontario, Calif.

Milling cutters can be quickly aligned with a T-slot in the table of the milling machine by means of the simple centralizing tool shown in the illustration above. The tool is placed on the milling machine table with tongue *A* in the T-slot. The table can then be adjusted until the milling cutter fits into the correct size slot in the top of tool body *B*. Various width slots are provided to accommodate different size cutters. By removing two bolts, the tongue can be easily replaced to suit various sized T-slots. The tool is made from carbon steel, hardened and ground.



Clamp equipped with a metal shield (M) which prevents chips from entering the slot for the clamping stud (A)

Chip Shield for Milling Fixture Clamps

By CLIFF BOSSMANN, Tool Engineering Department National Cash Register Co., Dayton, Ohio

In using a clamp for holding work to be milled as shown in the accompanying illustration, the operator frequently encounters difficulty from chips becoming lodged between the clamp screw *A* and the ends of the slot in clamp *C*. The chips cannot be easily removed from this space or slot, which has a length *L*, and therefore interfere with the proper operation of the clamp in holding down the work *W*. To overcome this difficulty, a simple shield *M* was devised.

Shield *M* slips over the clamp screw *A* and rests on the top side of clamp *C*. The turned down ears of the shield come in contact with the sides of the clamp *C* and prevent the shield from turning on the clamp. With the shield in place, the clamp can be slipped back and forth without having its slot exposed to chips from the milling cutter. A spring *S* serves to hold the clamp up in contact with the clamping nut.

* * *

Twenty-three tons of anti-friction bearings for installation in a hot strip mill in France have been ordered from SKF Industries, Inc. Seventy-six spherical roller bearings weighing a total of 45,756 pounds are included in this order. The bearings range from 2 to 3 feet in diameter and weigh up to approximately 1350 pounds.

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER
Lester, Hankins & Silver
Sales Management Engineers
New York and Philadelphia

The Dragon Reciprocity

TO many a machine tool salesman, reciprocity is either an ugly dragon or a guardian angel. When a competitor is a heavy buyer of our prospect's products, do we let down and offer this as an excuse for losing the order? On the other hand, when our company is a heavy buyer of our prospect's products, do we relax and enjoy the free ride?

Reciprocity has almost become a "hush word" in industry because it may imply that sales and purchases are made for reasons other than merit. The expression "trade relationships" is often used instead, being considered a more innocuous term. One thing is sure. When two companies find it mutually advantageous to buy from each other, the line of human contact becomes easier and more likely to be preserved.

Let us examine the procedure of a salesman when faced with an adverse reciprocal situation and with a favorable one.

An Adverse Reciprocal Situation

Take the case of a prospect who buys tools from a competitor, the competitor, in turn, consistently buying the products of the prospect. Every approach, every move in selling, must be based upon one very sound principle. This principle is that no manufacturer in a competitive market can be permanently successful unless he buys only the very best tools for the job in hand, irrespective of the supplier. Thus the salesman is faced with the important job of establishing value in the prospect's mind—and a degree of value which transcends that attached to the machine of the favored competitor.

Usually in such cases, the higher management of the prospect lets it be known that one or more competitors are to be given preferred consideration. Yet the shop men—those who use the tools —are responsible for the quantity and quality of the product, as well as the cost of production. Thus the salesman has the job of selling added value to them, and then of helping them sell their preference to those higher up.

This can be done, assuming the tool to be right, by superior and concentrated selling skill. The shop man can be led to speak up and insist that, in order to do the best job, he must have the best tools to work with. With the shop men firmly on your side, you are armed to reason both with the purchasing agent and with the higher management.

Many purchasing agents will never mention reciprocity nor admit that it governs their choice. The subject is commonly avoided. It may pay the salesman to take the initiative and bring it up in some such way: "Of course, Mr. P. A., no modern, progressive company permits reciprocity to determine his purchases. If he did, he could not be sure of getting the best for the money. He would ultimately lose. I know you have your company's interests at heart and want to buy wisely." Usually the purchasing agent agrees.

Successfully meeting an adverse reciprocal situation is a matter of careful planning, intensive selling to the right individuals, and putting up an endless fight.

A Favorable Reciprocal Situation

Every salesman who gets all the business from a given buyer is naturally in a dangerous position, because he is likely to relax and unconsciously become self-satisfied. The purchaser's management may wake up some time to the fact that such a condition exists, and start to scrutinize the wisdom of concentrated purchases. When a reciprocal situation favors you, vigilance

is essential, and a constant striving for further improvement must be made.

Sometimes you may fail to get business from purchasers who sell largely to your own company. But it certainly never pays to introduce reciprocity into your selling. However, it may be wise to utilize human contacts that result from buying. You might say to your prospect: "Our companies know each other. Mr. Jones, our purchasing agent, has often spoken of the happy relationships that exist between us."

Reciprocity is a two-edged sword in the hands of the machinery salesman. It will cut both ways, and may be thrust back at you. I remember blithely visiting a prospect, armed with a memo of the amount in dollars that my company bought from him during the preceding year, only to be rebuffed by the statement: "Why, one of your competitors placed over twice that amount of business with us."

Reciprocity is often a mental hazard. Recognize it and plan how to meet it, but carry on the fight even harder. Don't forget that every consistent and complete job of selling helps the prospect. You have brought valuable ideas to him. You have helped him solve a problem. Your selling effort deserves a reward, and it can be demanded in the proper way. Use a one-edged sword—a sword that won't be thrust back at you—to kill the dragon. And in cases where reciprocity might serve as a guardian angel, don't rely on it.

* * *

Fiftieth Annual Convention of the National Metal Trades Association

One of the most significant conventions in the history of the National Metal Trades Association —the fiftieth—was held at the Palmer House, Chicago, Ill., October 26 to 28, inclusive. The golden anniversary theme of the convention was "Forging Ahead with Fifty Years' Experience in Industrial Relations," and the program was designed to meet today's critical needs.

On Wednesday, October 26, the importance of employe communications was stressed by a full-day discussion of the topic "In-Plant Communication and How to Get It in Your Plant." Among the other major subjects considered at the convention were measuring the effectiveness of industrial relations programs; cost reduction; work simplification; health and sickness benefit plans; and collective bargaining. T. J. Morton, president of the National Metal Trades Association and head of the Hoosier Cardinal Corporation, Evansville, Ind., presided over the sessions.

A.S.M.E. Holds Active Fall Meeting in Erie

The Fall Meeting of the American Society of Mechanical Engineers, held September 27 to 30 at Erie, Pa., was well attended, and sessions were held on a broad line of subjects, including metals engineering, power, fuels, rubber, plastics, applied mechanics, materials handling, education, railroading, industrial instruments and regulators, management, gas-turbine power, heat transfer, production engineering, machine design, aviation, and petroleum.

At the session on education, which dealt specifically with industrial apprenticeships, papers were read by Roy Ellis, director of training, General Electric Co., Schenectady, N. Y., and De Forest Pratt, director of training, Cincinnati Milling and Grinding Machines, Inc., Cincinnati, Ohio. Both of these papers contained a great deal of interest to all who are concerned with apprentice education.

The session on materials handling covered practical problems in the handling of materials and scrap in large industrial organizations. Floyd E. Bliven, supervisor of salvage at the plant of the General Electric Co., Erie, Pa., spoke on "Efficient Scrap Handling Requires Many Types of Equipment." His paper covered a broad range of materials-handling problems, and dealt not only with the methods used, but also with the handling equipment itself. Another paper, entitled "A Materials-Handling Program from Vendor to Customer," which was read by Carl E. Blass, manager of planning, Talon, Inc., Meadville, Pa., presented a clear idea of the many problems involved in handling very light materials, as well as heavy and bulky products.

At the production engineering session, two papers were read—one on "Handling Time Versus Machining Time," and one on "Automatic Precision Assembly in Mass Production of Refrigerator Units." The first paper, which was presented by Edward L. Murray, engineer with the Warner & Swasey Co., Cleveland, Ohio, described the application of the "electro-cycle" system of spindle control to small-sized turret lathes for the purpose of reducing the machine handling time. Varied examples of work in ferrous and non-ferrous materials were used to present case study data.

The paper on the assembly of refrigerator units was presented by C. A. Rystogi, superintendent of refrigerator unit manufacturing, General Electric Co., Erie, Pa. This paper gave interesting details on the precision methods used in assembling refrigerator units in a large manufacturing plant.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

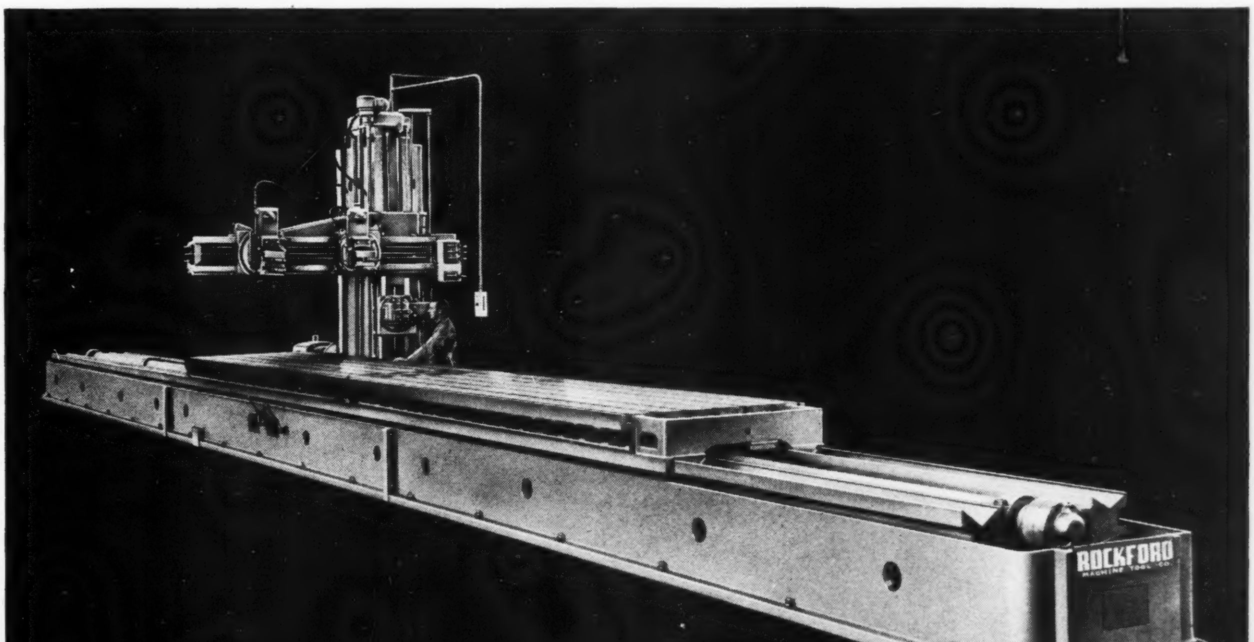
Rockford "Hy-Draulic" Open-Side Planer

The Rockford Machine Tool Co., Rockford, Ill., has brought out a new "Hy-Draulic" open-side planer with a 33-foot cutting stroke. This cutting stroke is longer than on any machine of this type previously built by the company. The machine is 73 feet long and about 14 feet high. The cutting speeds are infinitely adjustable up to a maximum suitable for carbide metal-cutting tools, even with the longest stroke.

A new hydraulic cylinder assembly design makes possible the longer stroke of this machine, and provides it with many of the advantages of the "Hy-Draulic" drive and feeds. Outstanding features include simple, sensitive hydraulic valve controls; fine finish and efficient cutting under "Hy-Draulic" drive; high-speed cutting and return strokes; low operating cost because of faster set-up; and minimum machine time.

A unique feature of the machine permits the speed of the return stroke to be set independently of the cutting stroke speed, so that a fast return stroke speed can be used regardless of the cutting stroke speed. The new open-side planer is built with two cross-rail heads and one side-head. The maximum planing width using the right-hand head is 60 inches; the maximum planing width using both heads is 72 inches; and the maximum distance from the table to the rail is 72 inches.

Rockford "Hy-Draulic" planers are built in both open-side and double-housing designs. The two massive columns of the double-housing planer give maximum support to the cross-rail tool-heads, which is essential in heavy-duty planer work. The single-column and cross-rail assembly of the open-side planer provides rigid support for the tool-heads and permits overhang of work that is wider than the machine table. Both double-housing and open-side "Hy-Draulic" planers can be supplied with two tool-heads for the cross-rail and one tool-head for the vertical side-rail, the second cross-rail head and the side-rail head being extra equipment. In addition to the new 33-foot stroke open-side planer, these planers are now being built in stroke lengths of 10, 12, 14, 16, 18, and 20 feet. 61



"Hy-Draulic" open-side planer with exceptionally long cutting stroke brought out by the Rockford Machine Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 234.

Bliss Straight-Side Single and Double Crank Presses

New lines of straight-side single and double crank presses have been developed by the E. W. Bliss Co., Toledo 7, Ohio, which conform to the recently established standards of the Joint Industry Conference. In general, these standards provide for additional capacity, compared to former standards. Thus the tonnage and weight capacities and bed and slide areas of these presses have been slightly increased.

The 150-ton press shown in Fig. 1 is the first of the new line, which features a rugged box construction with shrunk tie-rod frame of Meehanite castings. Single-end drive presses with capacities up to and including 250 tons have a new type of pneumatic friction clutch mounted on the crankshaft, which results in less heat and wear and gives longer uninterrupted service.

The 250-ton press illustrated in Fig. 2 is one of the double crank models being built at the company's Hastings, Mich., plant. The new straight-side presses, both single and double crank types, are built on a system of standards developed to achieve interchangeability of parts among presses of various sizes and types.

In order to extend the application of its line of single and double crank presses, the E. W. Bliss Co. has standardized on the barrel type slide adjustment shown in Fig. 3. This feature is particularly advantageous when using dies that vary greatly in height, as it eliminates the need for ring risers and stools. All adjustments can be made quickly through the motorized adjustment, which is self-locking. The adjusting worm has two anti-friction thrust bearings that insure accurate alignment and long life. 62

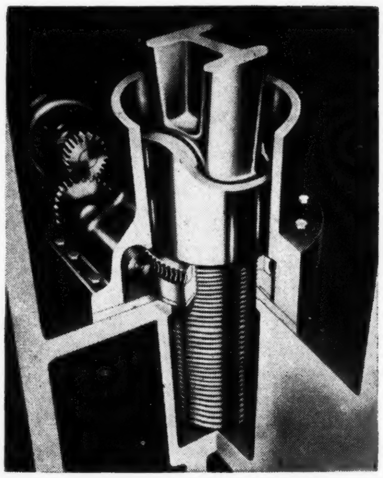


Fig. 3. Standardized barrel type slide adjustment employed on new line of crank presses built by the E. W. Bliss Co.

Rahn Granite Precision Angle-Plates

Precision angle-plates made of black granite to a tolerance of 0.00005 inch in 12 inches on the linear dimensions have been added to the line of the Rahn Granite Surface Plate Co., 1149 Platt Circle, Dayton 7, Ohio. The hardness and warp-free characteristics of the black granite are retained almost indefinitely. Granite has the advantages that it will not rust, accidental nicks do not raise any burrs on its surface, and abrasives cannot become embedded in its hard surface. These precision angle-plates are generated in sets of three by a special hand-lapping process. 63

Fig. 1. New press of 150 tons capacity built by E. W. Bliss Co.

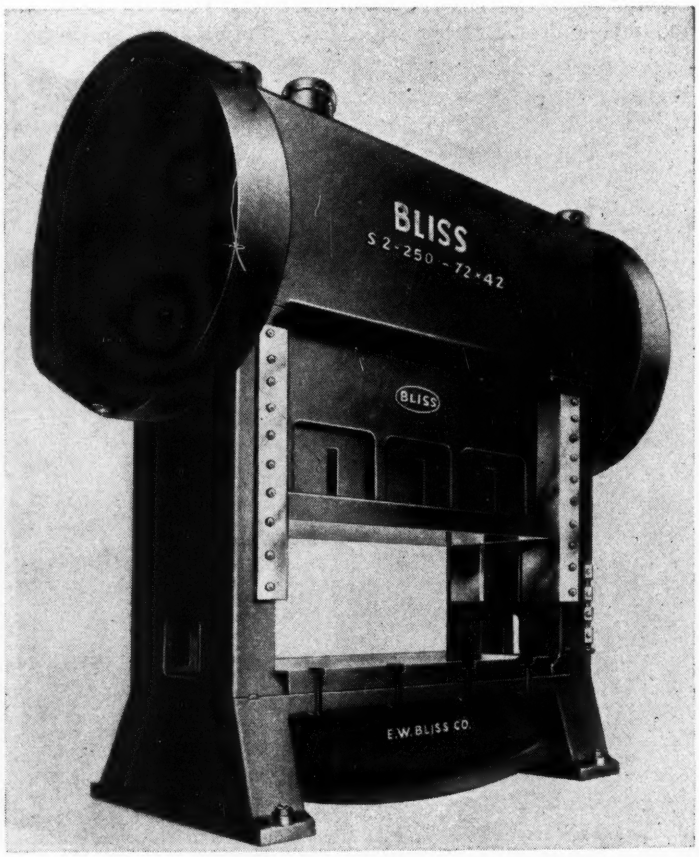


Fig. 2. Double crank press of 250 tons capacity brought out by the E. W. Bliss Co.

To obtain additional information on equipment described on this page, see lower part of page 234.

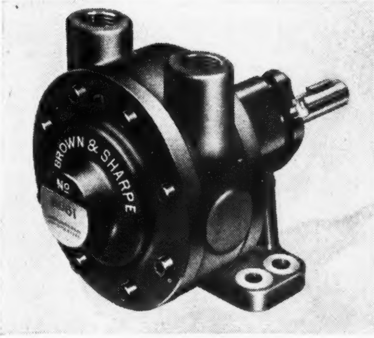


Fig. 1. Complete automatic reversing pump made by Brown & Sharpe

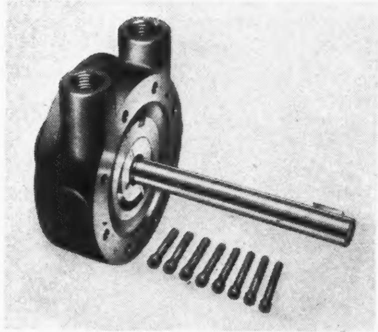


Fig. 2. Stripped model of pump shown in Fig. 1 with housing

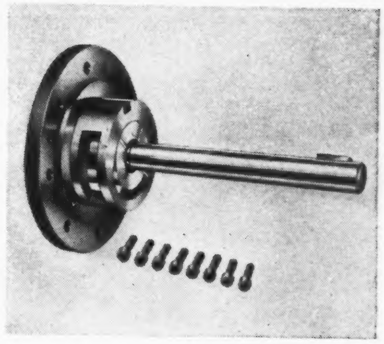


Fig. 3. Brown & Sharpe pump unit illustrated in Fig. 2 without housing

Brown & Sharpe Automatic Reversing Pumps

Nine styles and sizes of a new vane type automatic reversing pump have been added to the line of pumps made by the Brown & Sharpe Mfg. Co., Providence 1, R. I. The new pumps, one of which is shown in Fig. 1, are designed for continuous operation against pressures up to 100 pounds per square inch. The capacities, in gallons per minute at 0 pounds pressure, are from 0.6 to 2.5 for the No. 8021 pump; 1.4 to 5.4 for the No. 8061 pump; and 2.9 to 11.5 for the No. 8101 pump.

Pumps of similar capacities are available in stripped models with housings, as shown in Fig. 2, and without housings, as illustrated in Fig. 3. These designs have been developed to meet the growing demand of original equipment manufacturers for built-in or integral pumps. Outstanding examples of machines and equipment for which these pumps are especially adapted are Diesel engines, compressors, blowers, machine tools, and speed reduction units. 64

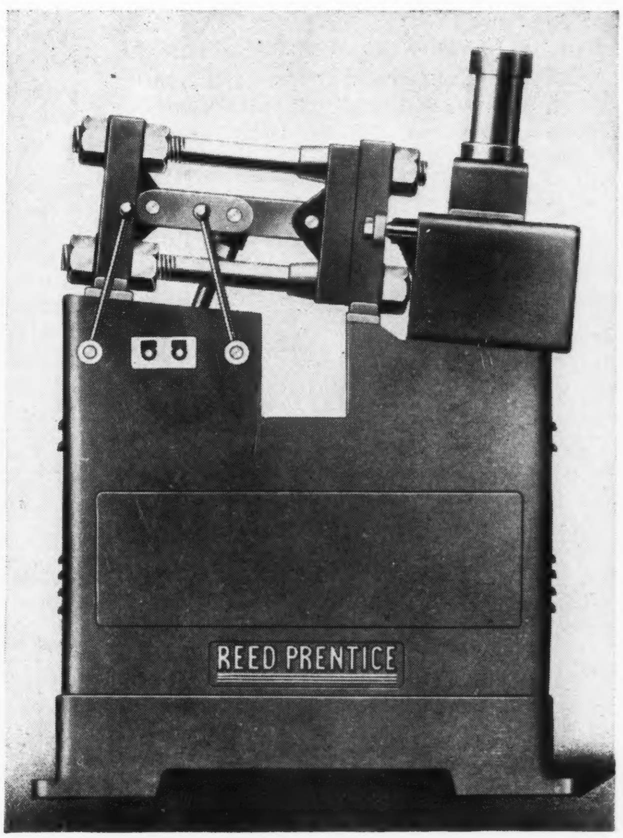
Fafnir Spherical Roller-Bearing Pillow Blocks

To round out its extensive line of anti-friction bearing industrial units, the Fafnir Bearing Co., New Britain, Conn., has developed a series of normal- and heavy-duty spherical roller-bearing pillow blocks. The spherical roller bearings for these units will be manufactured by the Torrington Co., Torrington, Conn.

The new units are designed especially to handle heavy loads with low power and maintenance costs. They will be available in bore sizes from 2 7/16 inches to approximately 8 inches. These pillow blocks are self-aligning, incorporating either felt or triple metallic labyrinth seals, and will be built for either straight shaft or adapter type mounting. 65

Reed-Prentice Small Size Die-Casting Machine Developed for High-Speed Production

A small self-contained machine designed for the high-speed production of lead, tin, or zinc-base die-castings has recently been added to the line of the Reed-Prentice Corporation, Department D-2, Worcester 4, Mass. This new Model 0 die-casting unit has a maximum shot capacity of one pound (zinc) and can be operated at production rates as high as 600 shots per hour, depending on the size and design of the casting. The capacity and speed of the machine make it well adapted for the rapid continuous production of small pieces such as knobs, handles, gears, and fittings.



Self-contained small size die-casting machine built by the Reed-Prentice Corporation

The No. 0 machine is operated manually through hydraulic pilot valve control levers. Plunger control is interlocked to prevent making the shot unless the dies are closed. The maximum casting area at a pressure of 1300 pounds per square inch is 9 square inches, adequate casting area being provided by die plates measuring 10 by 10 inches. The molten-metal holding pot has a capacity of 75 pounds (zinc). 66

To obtain additional information on equipment described on this page, see lower part of page 234.

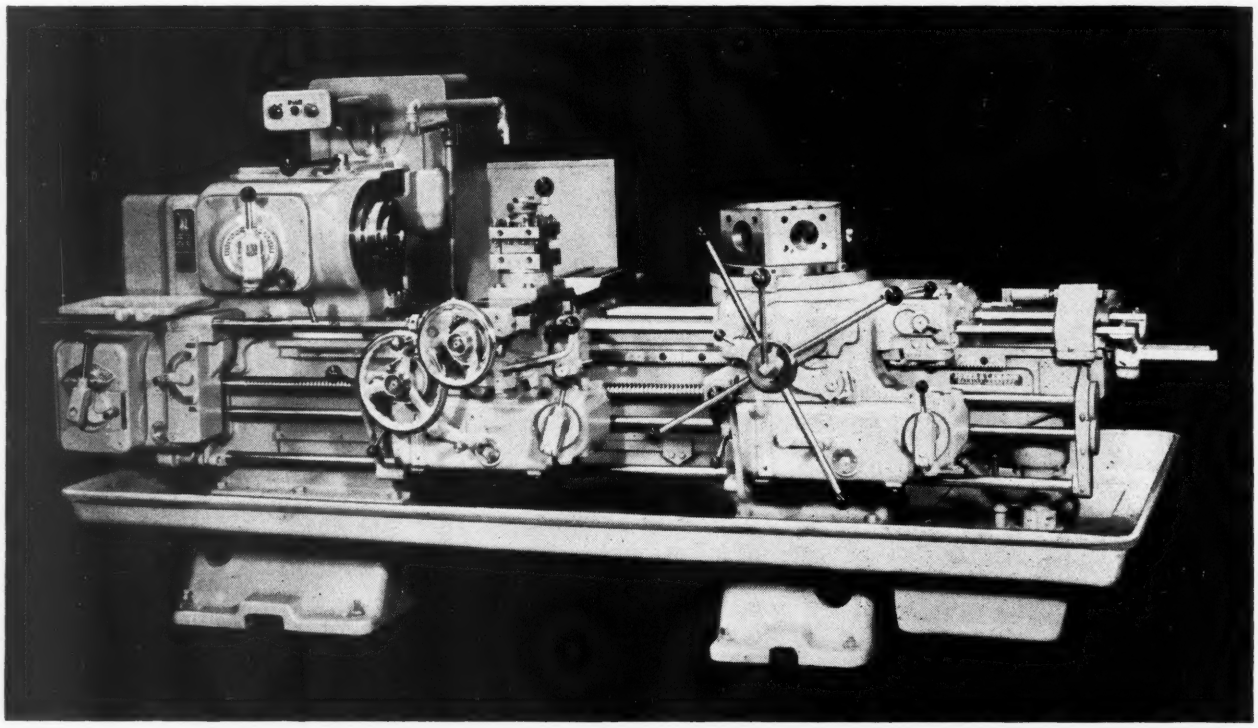


Fig. 1. Jones & Lamson saddle type universal turret lathe of improved design

Jones & Lamson Saddle Type Universal Turret Lathe

The Jones & Lamson Machine Co., Springfield, Vt., has announced an improved design of saddle type universal turret lathe with a capacity for handling bar work up to 2 1/2 inches in diameter and chucking work up to 12 inches in diameter. This Model 7A turret lathe has been completely redesigned to combine the many advanced construction and control features of the preceding model with improvements developed to provide maximum results in rapid, low-cost metal removal.

Ruggedness and versatility, easy operation, and fast metal removal, combined with repetitive accuracy, are outstanding features of this machine. The bed, in particular, is designed to emphasize strength and rigidity and to provide for more efficient chip disposal. Threading to maximum turning length with carriage or saddle is made possible by a full-length lead-screw. An all-sliding-gear, quick-change gear-box with a single-lever pitch selector provides for cutting a wide range of thread pitches.

Both the cross-slide and the saddle are equipped with power rapid traverse, and the turret is indexed by power. Two ranges of twelve spindle speeds—20 to 1000 R.P.M. or 30 to 1500 R.P.M.—are available with a constant-speed motor. Speed selections are made by a single control lever. The machine weighs over 4 1/2 tons without tool equipment. 67

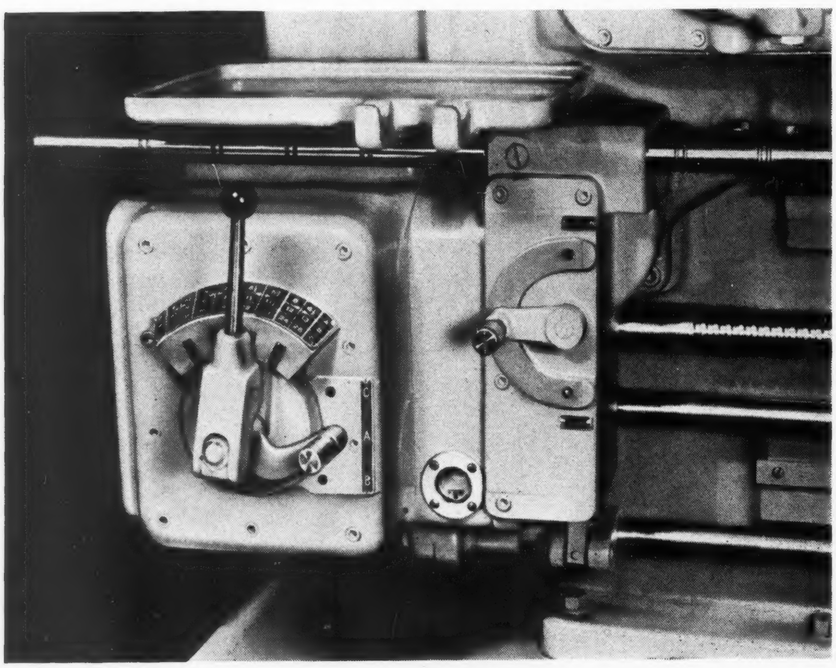


Fig. 2. Close-up view of all-sliding-gear quick-change gear-box and pitch selector lever

"Red Rocket" Power Hacksaw Blade

A new power hacksaw blade, designated the "Red Rocket," has recently been added to the line of metal-cutting saws manufactured by W. O. Barnes Co., Inc., Detroit 7, Mich. This blade is especially adapted for production work, its flexibility and toughness making it capable of withstanding heavy feeding pressures...... 68

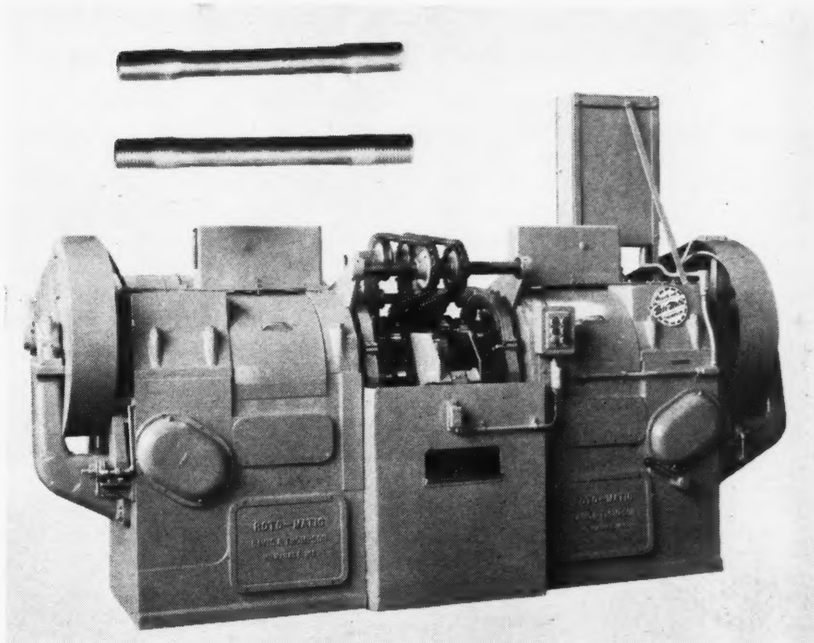
To obtain additional information on equipment described on this page, see lower part of page 234.

Lipe Magazine-Loading Pneumatic Bar Feed for B & S Automatics

The Lipe-Rollway Corporation, Syracuse 1, N. Y., has brought out a fully automatic magazine loading pneumatic bar feed, made in four models, for use on No. 00 and No. 0 B & S screw machines with spindle bores ranging from 9/16 to 1 inch in diameter. These new feeds permit one operator to take care of eight or ten machines, and are said to make possible increases in production up to 60 per cent. A pulley-driven tripping dog, actuated by the pneumatic control system, causes the top of the feed-tube to be moved backward and the bottom piece of stock held in the magazine to drop into the lower half. The top of the feed-tube is then returned and the push-rod begins its feeding movement.

The magazine holds sufficient stock for a normal eight-hour run. It can be loaded with nineteen bars 5/8 inch in diameter up to ninety-six bars 1/8 inch in diameter. The time required to load the magazine from a nearby stock pile is from 80 to 114 seconds.

The piece length capacity per feed-out or collet opening is from 0 to 16 inches. The feed-cylinder air pressure ranges from 18 to 35 pounds per square inch. 69



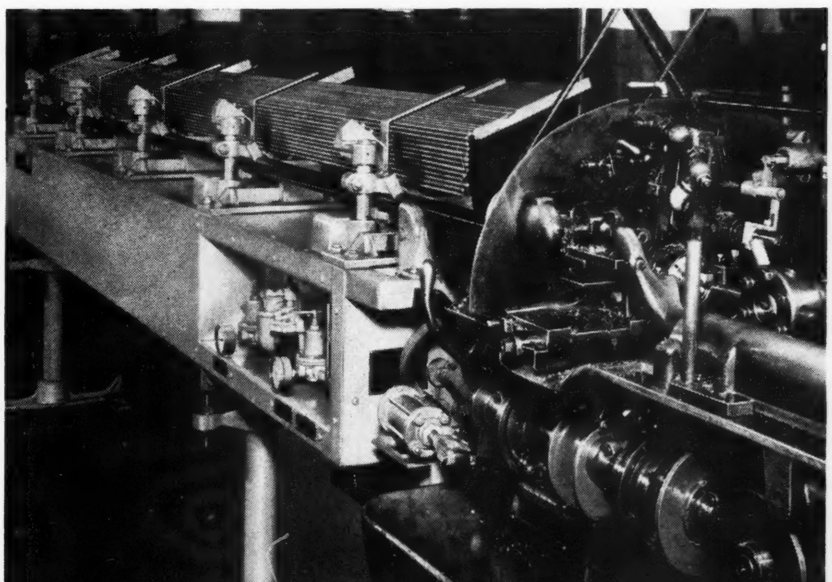
Double-end "Roto-Matic" threading machine developed by the Davis & Thompson Co.

Davis & Thompson Horizontal "Roto-Matic" Threading Machine

A "Roto - Matic" Type GG double-end horizontal continuous threading machine adapted for threading both ends of suspension arms has been brought out by the Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis. This machine has twelve spindles provided with lead - screw feed. The spindles carry die-heads at each end, making possible the continuous threading of work-pieces from both ends. The continuity of the thread is maintained by lead-screw bushings which always have the same relative positions.

The work is loaded at the open station by the operator while the machine is running. As the pieces progress through the machine cycle, they are held by equalizing jaws in the fixture through a chain clamping arrangement. The lead-screw is positively engaged and the die-heads fed onto the work-piece. When the threading operation is completed, the die-heads are opened by an outside contact ring, the lead-screw released, the spindle returned to its starting position, the fixture automatically unclamped, and the work rolled into the discharge chute.

The lead-screws are engaged before the dies contact the work-pieces, and are not disengaged until after the die - heads are opened by the trip. The particular machine illustrated has a production of 1060 suspension arms per hour. However, a production of 1500 or more pieces per hour is possible, depending upon the type of work and the characteristics of the material machined. 70



Magazine-loading pneumatic bar feed for B & S automatics, made by the Lipe-Rollway Corporation

To obtain additional information on equipment described on this page, see lower part of page 234.

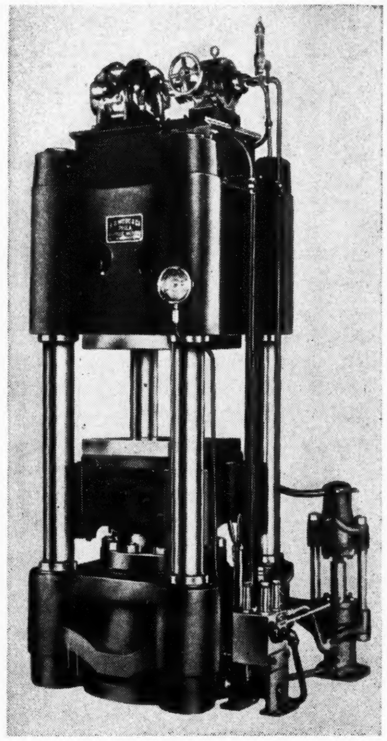
Knight Heavy-Duty Vertical Milling, Drilling, and Boring Machines

A new "Electromill" which permits an exceptionally wide latitude in selecting various features to meet specific machining requirements has just been introduced by the W. B. Knight Machinery Co., 3920 W. Pine Blvd., St. Louis 8, Mo. This machine can be equipped either with variable-speed motors to provide versatility or with constant-speed motors for specialized production work. Changes can easily be made to suit various conditions on milling, drilling, and routing operations either in the experimental shop or on the production line.

The sturdy table and saddle travel on rollers. They are designed to eliminate overhang and yet are sufficiently compact to allow both table and saddle handwheels to be easily operated simultaneously. The ribbed base supports the heaviest work. The column has an unusually deep throat and spindle head, with an extra long quill that gives the machine its exceptional capacity.

The heavy V-belt drive and built-in flywheel with variable-speed range provide a smooth drive. Speed and feed changes are electronically controlled, and are effected by means of a small knob. Both speeds and feeds can be increased while the machine is in operation. The cutter can be stopped instantly by means of a control button.

The power feed to the table and saddle is completely controlled from a panel which the operator can move to any desired position. A lever type safety stop switch, mounted on the bottom of the panel, stops the power drives in the entire machine. Safety clutches prevent jamming of the feed or overloading of the drive. 71

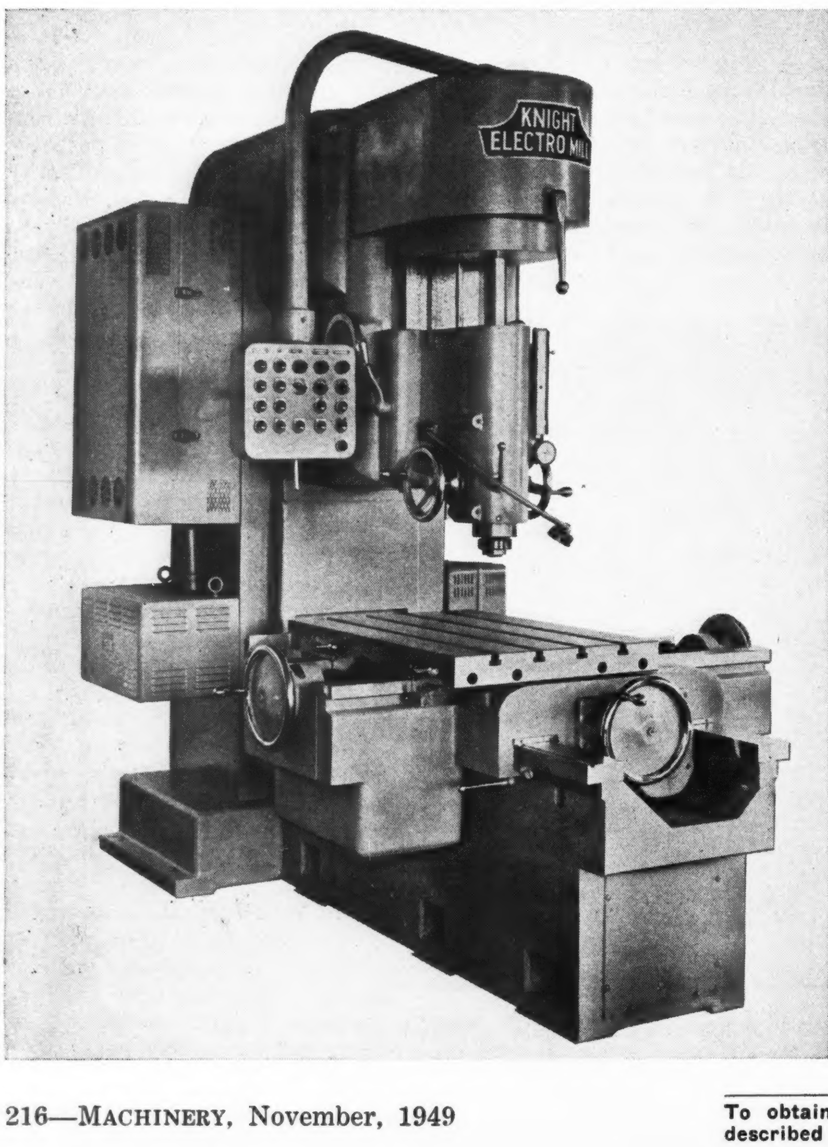


Hobbing press built by R. D. Wood Co.

Hobbing Press with Two Pressure Ranges

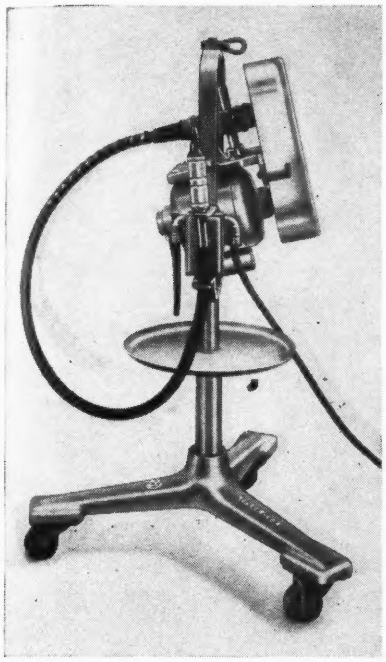
A 1000-ton "up moving" type "Hydro Lectric" press has been developed recently by the R. D. Wood Co., Public Ledger Bldg., Independence Square, Philadelphia 5, Pa., for the accurate hobbing of intricate single- and multiple-cavity molds. This hydraulic hobbing press has a working surface of 24 by 30 inches. The platen is precision made of ribbed box-section cast steel with a cavity designed for multiple split-ring type packing.

A working pressure of 3000 pounds per square inch is supplied to the ram by a rotary piston type pump with a displacement of 4 1/2 gallons per minute. By the use of a hydraulic intensifier, a pressure of 6350 pounds per square inch can be obtained. Power for the adjustable pressure pump is supplied by a direct-connected 7 1/2-H.P. electric motor. The press is controlled through a lever-operated four-way valve. Protective devices, hydraulic pressure gage, wiring, and all necessary valves and all control equipment are supplied with the unit. 72



Heavy-duty vertical milling, drilling, and boring machine brought out by the W. B. Knight Machinery Co.

To obtain additional information on equipment described on this page, see lower part of page 234.



"Kellerflex" multiple-speed flexible-shaft machine

"Kellerflex" Flexible-Shaft Machine

A new Series M Kellerflex multiple-speed flexible-shaft machine, designed for use in the manufacture of a wide variety of products requiring burring, filing, sanding, grinding, wire-brushing or polishing, has been brought out by the Pratt & Whitney Division Niles - Bement - Pond Co., West Hartford 1, Conn. This machine is built to perform equally well on a wide range of work, from heavy-duty grinding to fine, delicate polishing. It can be mounted on floor and bench stands or suspended from an overhead fixture. All fittings are standard for Pratt & Whitney attachments and hand-pieces.

Sixteen constant shaft speeds are obtained by adjusting two clamps and rearranging the sheaves of the jack-shaft pulley. The Series M Kellerflex machines are available in two standard speed ranges of 1000, 2500, 4250 and 6000 R.P.M., and the other of 2000, 5000, 8500 and 12,000 R.P.M. Different speed combinations within each range can be obtained by shifting the single sheaves of the jack-shaft pulleys.

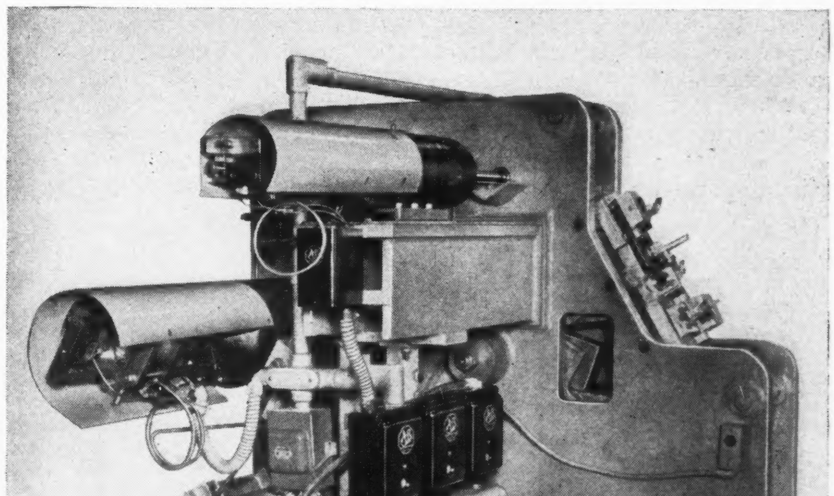
The jack - shaft spindle is mounted on ball bearings and transmits its drive directly to a piloted cable. The entire unit is balanced in an all-steel yoke. swings through an ample vertical arc, and has a 360-degree horizontal motion, eliminating cramping of the shaft and insuring economical operation, greater flexibility, and smooth operation, without tendency to whip or bind. 73

Special Machine for Drilling, Hollow-Milling, and Tapping Bicycle Pedal Cranks

A specially designed semi-automatic machine with a rotary indexing work-holder for performing four different operations on a bicycle pedal crank is equipped as shown in the illustration with drilling, tapping, and hollow-milling units made by the Black Drill Co., 1400 E. 222nd St., Cleveland 17, Ohio. The illustration (furnished through the courtesy of the Barth Stamping & Machine Co., Cleveland, Ohio) shows three of the five units, the other two units being mounted on the opposite side of the machine.

The drilling, tapping, and hollow-milling units are operated by air, with a hydraulic check for feed control. They are available in all standard induction motor speeds for operation on polyphase currents of 209, 220, 440, and 550 volts. Standard units from 1/4 to 3 H.P. and special units up to 10 H.P. are obtainable. They are built to operate in any position or at any angle, so that they can be readily installed in transfer and indexing type machines for fully automatic or semi-automatic operation. This flexibility facilitates modifying the units to incorporate extended shafts and extra long strokes.

All five units of the machine illustrated operate electrically through solenoids and limit switches that will not permit any of the units to advance until the machine has been indexed to exactly the correct position, and will not allow the machine to be indexed until the units are all withdrawn to their normal starting positions. 74



Special machine with units made by the Black Drill Co. for drilling, hollow-milling, and tapping bicycle pedal cranks

To obtain additional information on equipment described on this page, see lower part of page 234.

Warner & Swasey Overhead Threading Attachment for Turret Lathes

An overhead threading attachment designed to speed up single-point thread-chasing operations on non-ferrous metals has been brought out by the Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio, for use on this company's universal turret lathes. The attachment is mounted at the rear of the turret lathe headstock. A screw-adjusted slide tool-holder extends to the right of the spindle. The fixed overhead bar supports a counterweighted chasing bar on which a guide arm and the chasing tool arm are located. When the chasing tool arm is lowered, a follower at the headstock end of the chasing bar engages a leader driven by gears from the spindle, moving the bar and attached tool longitudinally in accordance with the pitch of the leader-follower combination chosen.

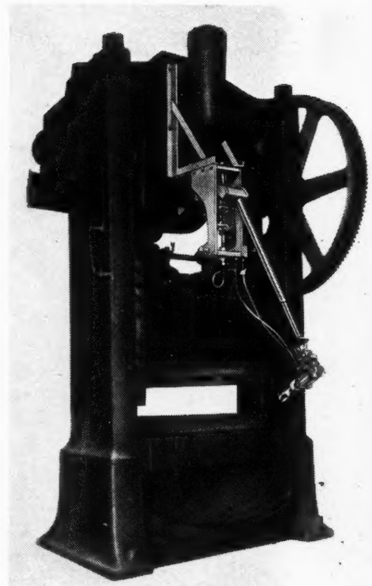
An adjustable bracket fixed to the head of the machine provides a slide on which the guide arm rests for positive guiding of the chasing tool. The slide can be tilted for threading pipe. The length of thread that can be cut at one time is 4 1/4 inches.

When the thread is cut to the desired length, the operator swings the chasing arm up and lifts the tool from the work. The chasing bar counterweight keeps the arm in the raised position. A compression spring returns the chasing bar longitudinally to its original position ready for the next cut. 75

Rockwell Portable Rotary-Hearth Forge Furnace

A rotary-hearth furnace designed to insure a supply of clean, uniformly heated forgings for the forging hammer is being built by the W. S. Rockwell Co., 200 Eliot St., Fairfield, Conn. Although the work hearth is only 4 feet in diameter, this furnace is capable of producing up to 900 pounds of forgings per hour, heated to a temperature of 2100 degrees F. The work is charged and discharged through a single slot 9 inches wide by 2 1/2 inches high.

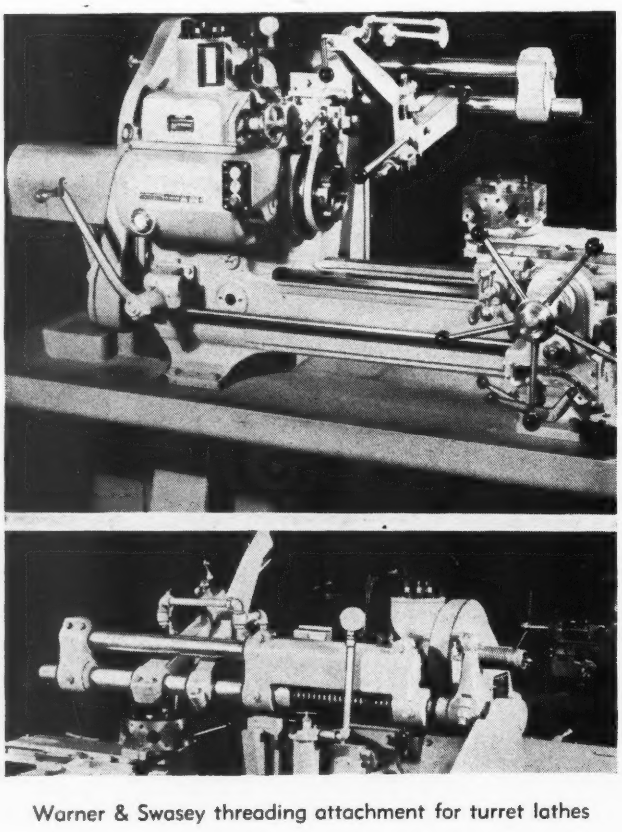
The furnace atmosphere is carefully controlled to produce a light scale that will flake off easily with the first blow of the forging hammer. Heating cycle is from twelve to thirty-six minutes, but can be easily changed as desired. 76



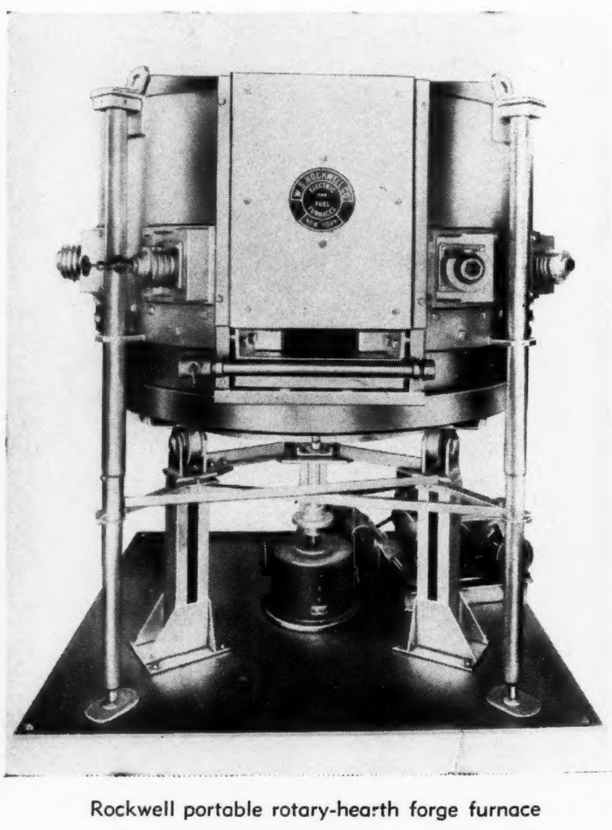
Press equipped with junior size "Iron Hand" made by the Sahlin Engineering Co.

Junior Size "Iron Hand" for Unloading Small Presses

A junior size "Iron Hand," designed especially for use on small and medium-sized punch presses has been announced by the Sahlin Engineering Co., 467 S. Woodward Ave., Birmingham, Mich.



Warner & Swasey threading attachment for turret lathes



Rockwell portable rotary-hearth forge furnace

To obtain additional information on equipment described on this page, see lower part of page 234.

The new "Iron Hand" is recommended for use in removing metal stampings automatically from presses with bed widths up to 72 inches and pressure capacities up to 250 tons. It has essentially the same design and operating features as the original "Iron Hand" described in December, 1948, MACHINERY, page 204, but is more compact and is especially adapted for high-speed operation. 77

Colonial Universal Broaching Machines

A line of universal ram type hydraulic broaching machines developed to meet the need for low-cost equipment of this type, has been brought out by the Colonial Broach Co., Box 37, Harper Station, Detroit 13, Mich. These new "Ram - Press" machines can be used for all conventional broaching operations, including surface broaching, internal push-broaching, slotting, and press work. They are available in 4-, 6-, and 10-ton capacities, and can be obtained with stroke lengths of either 24 or 36 inches.

Despite their low price, the machines of this new line are said to be of high quality construction. The columns are of heavy welded steel with full-length hardened and ground ways for the ram slide. The hydraulic system is designed to provide excess capacity for occasional overloads. The coolant system has its own separately motorized impeller type pump, eliminating belts and pulleys. Separate start and stop controls are provided for the coolant and hydraulic pumps. Stroke adjustments can be made quickly and accurately by means of externally located collars on a trip-rod at the side of the ram. These controls provide automatic stopping of the machine at the top and bottom of the stroke.

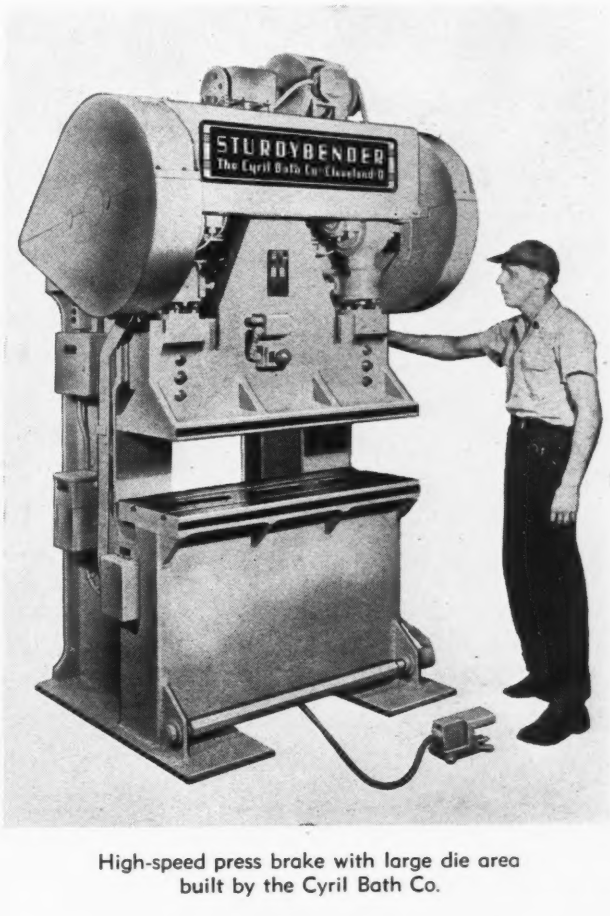
A large bracket bolted to the ram face can be used for internal push-broaching and for single or multiple assembly and press work. The machines can be furnished with special circuits for operating receding tables or fixtures required for special surface broaching operations. They can also be tooled up for simultaneously slotting and surface-broaching two separate pieces. 78

Cyril Bath High-Speed Press Brake

A new press brake designed for speeds up to 80 strokes per minute, which has wide bed and ram areas for the mounting of punching and blanking dies, is being built by the Cyril Bath Co., 6955 Machinery Ave., Cleveland 3, Ohio. This machine is equipped with press-control safety mechanism, which can be used either for continuous operation or for stopping the ram automatically at the top of its stroke. Overload protection is also provided. Accidental application of excessive loads automatically throws out the clutch.

The press shown is of 35 tons capacity, with a die area of 15 by 42 inches. Presses with heavier tonnage and larger die areas are also available. Operating cost reductions can be achieved by combining two or more operations in sequence and by reducing equipment and floor space requirements. Greater convenience and speed of the machine are said to cut the usual production time in half. Flexible ram settings and low die cost are other advantages claimed for the new press. 79

Colonial broaching machine adapted for either push-broaching or press work



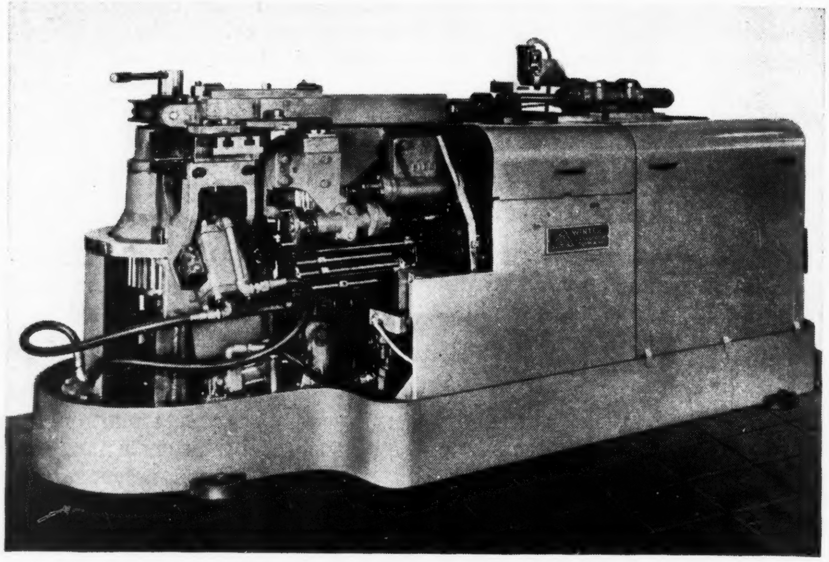
High-speed press brake with large die area built by the Cyril Bath Co.

To obtain additional information on equipment described on this page, see lower part of page 234.

Acme-Winter High-Speed Tube-Bending Machine

An automatic high-speed, hydraulically operated universal tube-bending machine is a recent development of the Acme-Winter Corporation, Buffalo 13, N. Y. This machine is furnished in several sizes for bending tubes up to 3 inches outside diameter with a wall 1/4 inch thick or larger size tubes of an equivalent cross-sectional area. The machines are indexed automatically, and are equipped with six automatic stops for making bends of different angles. Either right- or left-hand bends can be made with the standard dies. The benders can be furnished with hand control and automatic mandrel ejector.

The short bending head allows the operator to work in front of the machine. Special extension tables and adjustable gages can be furnished to suit the user's needs. The machine is of single unit design, having a motor and oil tank located in the base or pan, and all valves and pipe connections above the base to prevent oil from reaching the floor should leaks occur. The bending head is made of cast steel, is fitted with needle bearings, and is operated by a rack and pinion. 80



Acme-Winter high-speed automatic tube-bending machine

Sheffield Gaging and Segregating Machine

An automatic "Airlectric" gaging, classifying, and segregating machine for automotive connecting-rods has been developed by the Sheffield Corporation, Dayton 1, Ohio, for one of the largest automobile manufacturers. With this new machine, automotive connecting-rods can be gaged for all critical dimensions and conditions, stamped with the proper classification, and segregated at the rate of one every five seconds. The ingenious coordination of patented pneumatic and electrical circuits with mechanical actuating devices makes possible automatic gaging of the true diameter, average diameter, out-of-roundness, taper, squareness of face with bore, center distance between holes, width, bend, twist, and other important dimensions.

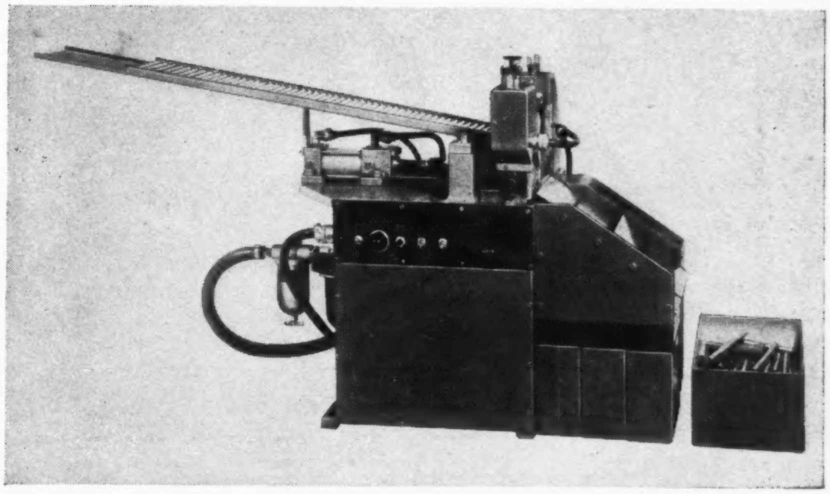
Only one operator is required for loading the connecting-rods on eight continuously rotating locating platforms on a turret wheel which indexes in 45-degree stages. The parts are checked at each of the gaging stations mounted above the wheel. All checking is done with air by means of the Sheffield "Airlectric" gaging head used in all pneumatic circuits at each station. Safety switches instantly stop the machine if interference is encountered. An additional safety provision consists of an arm and switch that prevent the operator from reaching beyond the loading position.

A light panel facilitates setting up the machine and indicates to the operator which dimensions and conditions of rejected parts are beyond allowable limits. The gaging mechanisms are sufficiently sensitive to check to much

Automatic "Airlectric" gaging, classifying, and segregating machine for connecting rods developed by the Sheffield Corporation

To obtain additional information on equipment described on this page, see lower part of page 234.

closer tolerances than are actually required, even under the conditions of continuous mass production. 81

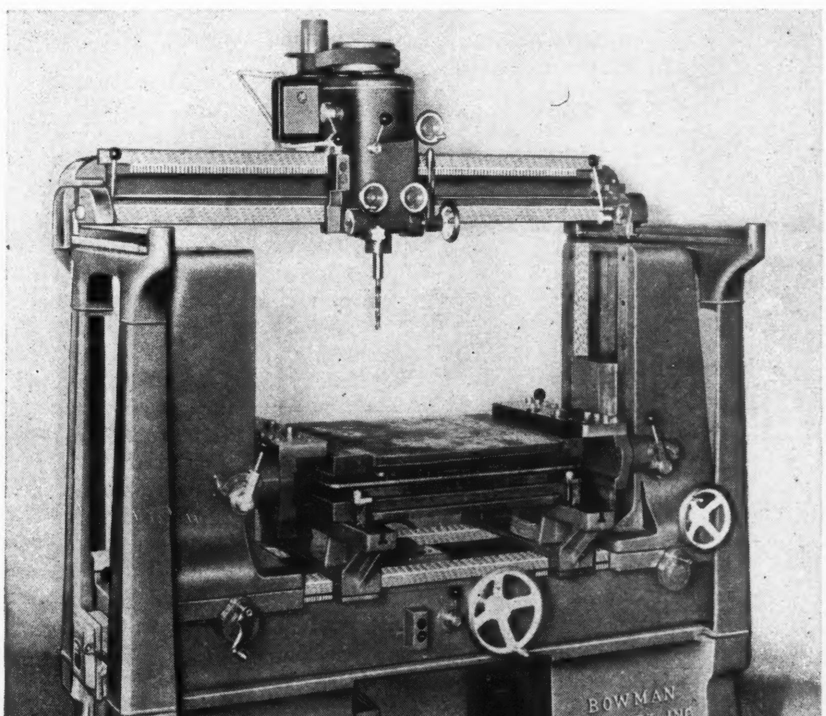


Special electronic sorting and gaging machine built by the Brown & Sharpe Mfg. Co.

Brown & Sharpe Electronic Sorting and Gaging Equipment

The Brown & Sharpe Mfg. Co., Providence 1, R. I., is now designing and building special automatic and semi-automatic inspecting and sorting equipment of simple, sturdy construction, which is said to be stable in operation, easy to manipulate, and of a high degree of sensitivity. The new gaging machines can be made to meet individual needs with respect to volume of product. They can be designed for manual loading and unloading; manual loading and automatic unloading; or automatic loading and unloading.

With the new machines, it is possible to segregate a product into any number of categories, each of which can be arranged for any dimensional width. The particular machine illustrated is designed to gage and sort straight sleeves, measuring the length and the diameter at both ends. The sleeves thus measured are sorted into four categories — over-size and under-size in length, regardless of diameter; small in diameter at either or both ends; large in diameter at either or both ends; and sleeves that are within the required tolerance. Parts are handled at a rate of approximately 3000 per hour on this machine, which is manual loading and automatic unloading. 82



"Die-Processor" designed for rapid, accurate production and repair of die-sets, developed by Bowman Products, Inc.

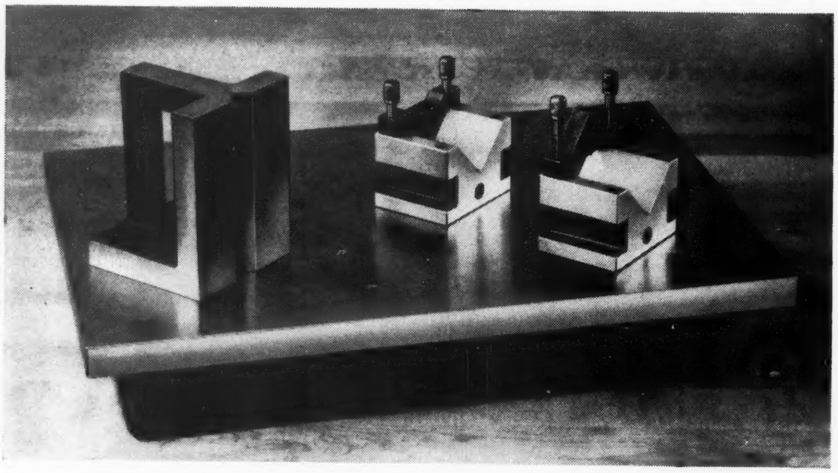
Bowman "Die-Processor" Developed to Speed Up Die Production

Bowman Products, Inc., University and Cromwell Aves., St. Paul 4, Minn., has developed a machine called the "Die-Processor" to facilitate the machining, fitting, and testing of dies. This machine is manufactured in two sizes for handling die sets up to 42 and 66 inches long. Either machine will handle die sets up to 36 inches wide having a shut height of 5 1/2 inches with the die-shoe on the parallel tables. The die-shoe and parallel rails can be quickly removed to permit die sets of greater shut height to be swiveled to any desired position.

A motor-driven variable-speed drill head facilitates rapid, accurate drilling of holes up to 1 inch in diameter on the top, sides, or bottom of the punch-holder or die. Provision is made for clamping the entire die-set together for movement as a single unit. The punch-holder can be elevated on power-controlled index-plates, and can be locked firmly in a vertical or horizontal position, with either the top or bottom in the most accessible position.

The smaller machine requires a floor space of 71 by 80 inches, is

To obtain additional information on equipment described on this page, see lower part of page 234.



South Bend surface plate, V-blocks, and angle-plate

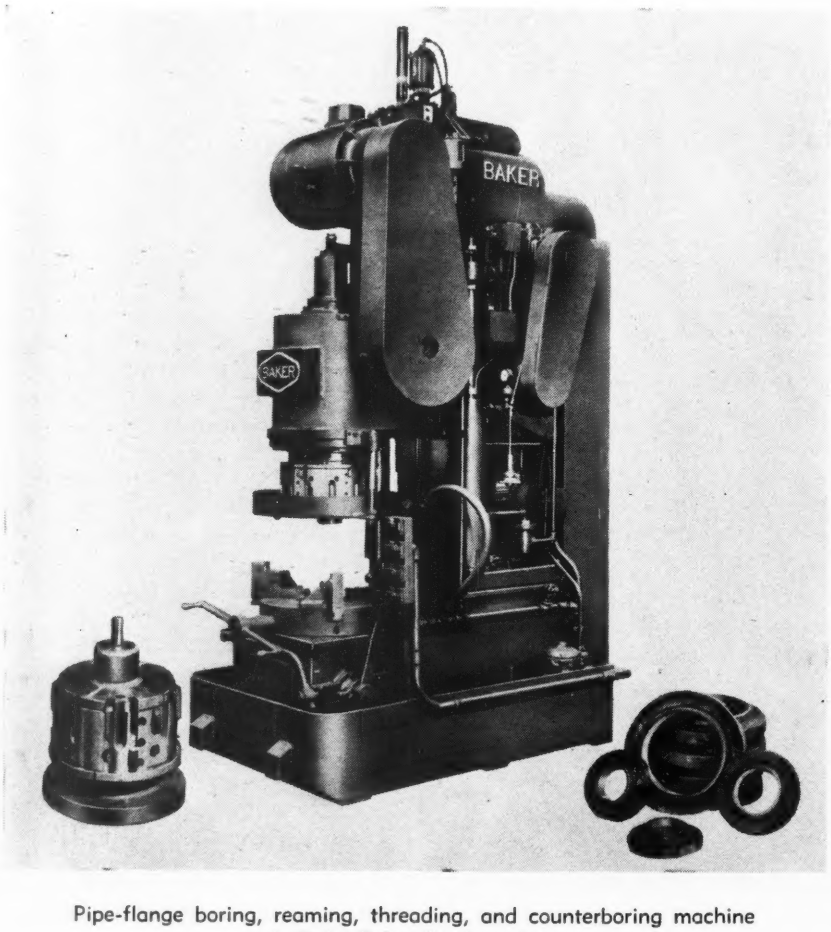
90 inches in height, and weighs 5500 pounds, while the larger machine requires a floor space of 71 by 104 inches, is 90 inches high, and weighs 6100 pounds. 83

South Bend Surface Plate and Accessories

A heavy cast-iron surface plate for laying out work, checking flat surfaces, and general tool-room and shop use is now available from the South Bend Lathe Works, 383 E. Madison St., South Bend 22, Ind. This plate is 12 by 17 by 3 inches in size, and has a top 3/4 inch thick. It is made of a close-grained iron having a high resistance to wear, and is heat-treated to prevent distortion. The surface is precision ground and all edges are accurately machined. The bottom is heavily ribbed and has three-point support.

The toolmakers' V-blocks shown on the surface plate in the illustration are also a new product of the company. These V-blocks are made of hardened steel, with all surfaces precision-ground. They are supplied in matched pairs only. Each block has a clamp with knurled clamping screws which are cross-drilled for tightening with a rod. The blocks are 2 15/16 inches wide, 1 15/16 inches high, and 2 1/4 inches long, and have a capacity for supporting round work from 1/4 inch to 2 inches in diameter.

Another new product of this company is the angle-plate shown in the illustration. This angle-plate is precision-ground on six sides, and is intended for use with the surface plate. It serves as a square for laying out and setting up work, and is especially applicable for checking and finishing right-angle surfaces. The angle-plate is 3 1/4 by 3 1/4 by 4 1/4 inches in size, and has a 5/8-inch V-groove. 84



Pipe-flange boring, reaming, threading, and counterboring machine built by Baker Brothers, Inc.

Baker Pipe-Flange Boring, Reaming, Threading, and Counterboring Machine

A machine designed to reduce the operating time required for boring, reaming, threading, and counterboring cast-iron pipe flanges has just been added to the line of Baker Brothers, Inc., Toledo, Ohio. This 30H04 machine is equipped with a three-jaw scroll and chuck, and will handle flanges for all pipe sizes from 3 to 16 inches.

Murchey special full-receding pipe taps having quick-change chasers and reamer blades are used to perform the various operations in rapid succession. The machine is equipped with a worm and worm-gear drive-head, and is arranged with sliding gears to provide two speeds, additional speeds being obtained by pick-off change-gears.

The operating cycle consists of rapid advance of saddle through hydraulic feed pressure to predetermined point where taper reaming operation begins; half-nut closes, providing positive lead-screw feed of saddle for reaming, tapping, and counterboring operations; and half-nut opens and saddle is returned at rapid rate to raised position by hydraulic pressure. 85

To obtain additional information on equipment described on this page, see lower part of page 234.

Westinghouse Direct-Current Welders Using Plate Type Rectifiers

A welding machine designed to combine the desirable characteristics of direct-current welding with the advantages of alternating-current welding machines has been developed by the Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. The new welder uses high-voltage selenium rectifiers, and is available in 200-, 300-, and 400-ampere ratings. It is of the industrial, single-operator type, and can be equipped with heavy-duty running gear for portable use over rough floors or tracks, as shown in the view to the left in Fig. 1; with 5-inch swivel-mounted wheels for ordinary portable use, as shown in the central view; or with skids for stationary mounting, as illustrated in the view at the right.

The welder consists of three essential elements—a three-phase transformer *A*, Fig. 2, used to supply suitable voltage to the rectifier unit; a three-phase adjustable reactor *B*, Fig. 3, which gives an essentially linear-scale current adjustment throughout the operating range of the welder; and a three-phase full-wave rectifier *C*, Fig. 2, which consists of six stacks of rectangular selenium cells, arranged in groups and connected in parallel to give full-wave rectification of the three-phase current.

Fig. 2 shows the baffle plates that direct air drawn by an exhaust fan (Fig. 3) through an opening in the base up through the filter, the reactor and transformer windings and the rectifier unit, exhausting it out of the grille on the side of the cabinet.

Efficiency of the new welder at the rated load is said to be 66 per cent, compared with 54 per cent for an average motor-generator welder. The efficiency increases under reduced loads, reaching 73 per cent at 20 per cent rated load. Since experience indicates that the average welding machine is actually loaded only one-third of the time and is idle two-thirds of the time, the greatly reduced no-load power consumption of the new welder results in a great saving in operating costs.

Other advantages include the extremely rapid response to the changes in current and voltage conditions produced by the welding arc, and negligible inductance in the direct-current circuit, which results in a very small time constant. With these characteristics "over-shoots" and "under-shoots" resulting in changes from loading requirements are small and of short duration. Operation is said to be especially good when welding with electrodes at low current densities.

The welder is designed to simplify maintenance, which is kept at a minimum by the elimination of moving parts, brushes, brush-holders, and shunt and series fields, with their control requirements. The door on the side of the welder facilitates inspection of all essential parts, permitting cleaning or changing of the air filter when necessary.

The 200-ampere welder is 44 1/2 inches high, 20 inches wide, 23 inches deep, and weighs 445 pounds; the 300-ampere welder is 47 1/2 inches high, 23 inches wide, 23 inches deep, and weighs 510 pounds; and the 400-ampere welder has the same dimensions as the 300-ampere machine, and weighs 570 pounds. 86

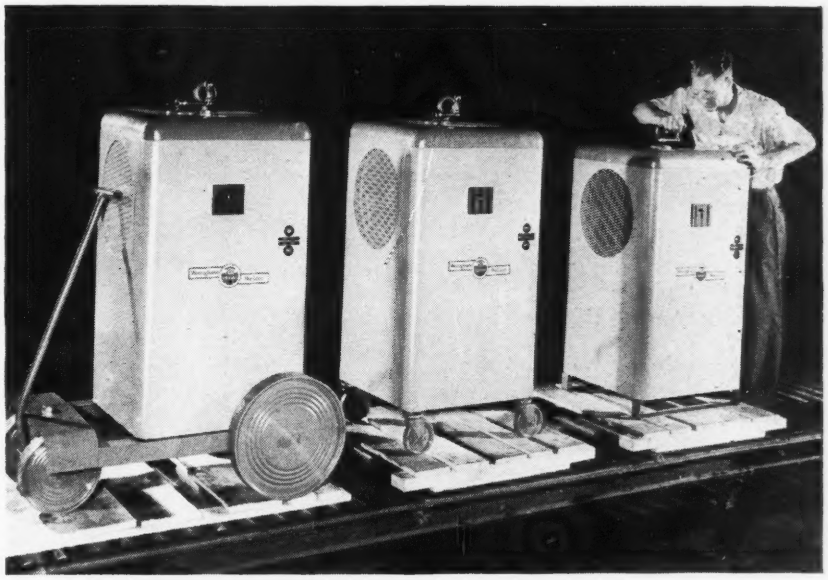
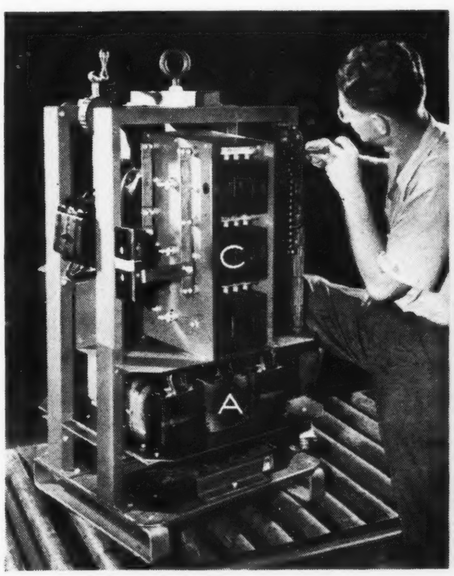


Fig. 1. Westinghouse direct-current welders using plate type rectifiers, shown with two different types of portable and one stationary type of mounting



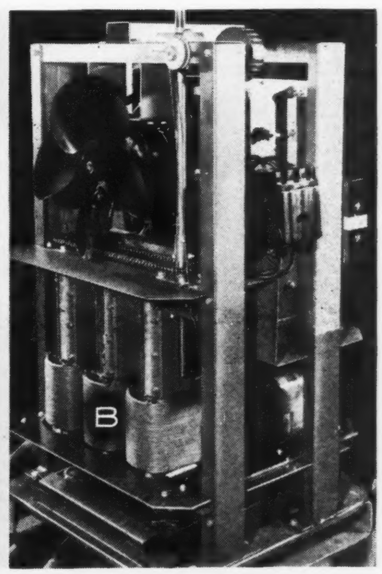


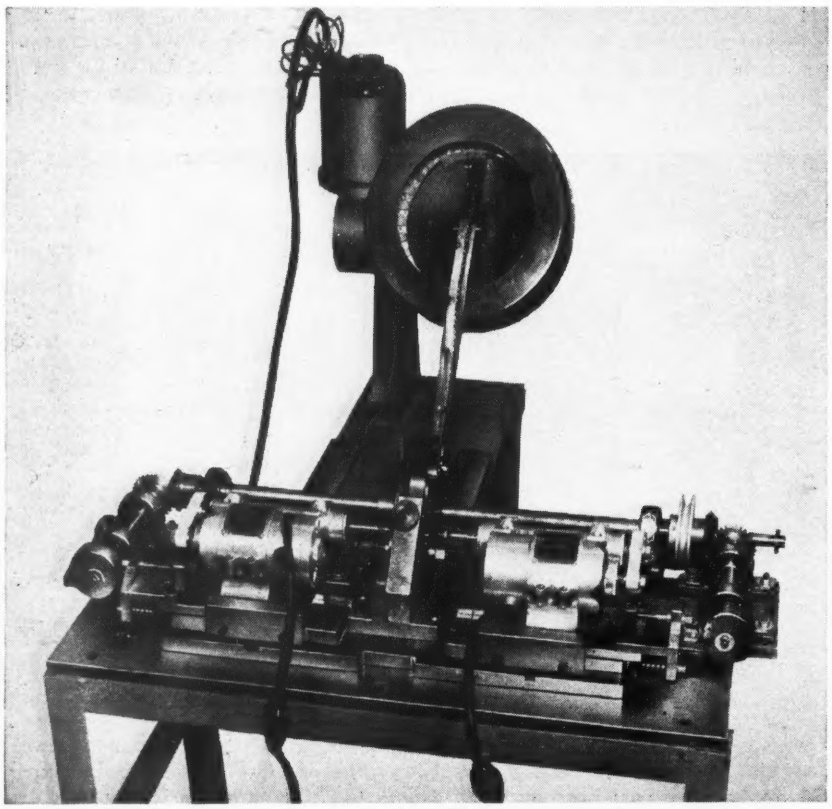
Fig. 2. (Left) Assembler wiring terminal of new Westinghouse direct-current welder after rectifier unit, three-pole circuit-breaker, lifting eye, and current indicator drum have been installed. Fig. 3. (Right) View of welder illustrated in Fig. 1 with case removed to show the exhaust fan powered by 1/12-H.P. pre-lubricated, ball-bearing, totally enclosed motor

To obtain additional information on equipment described on this page, see lower part of page 234.

Walsh Burring and Chamfering Machine

The Walsh Specialty Co., Inc., 536 S. Shawnee St., Lima, Ohio, has brought out an automatic double-ended burring and chamfering machine for burring or chamfering holes in nuts, washers, collars, spacers, pawls, and similar parts at the rate of 100 pieces per minute. The two burring heads feed inward to burr or chamfer both sides of the work simultaneously, or in cases where one side is already chamfered, the heads will chamfer the opposite side, regardless of the position in which the work is fed into the machine.

A motorized hopper and feed track carry the parts to a pick-up cam on the machine. All that is necessary to keep it in continuous operation is to maintain a supply of parts in the hopper. One machine can handle a large variety of parts within its established size range. To change from one part to another, it is only necessary to change the pick-up cam, adjust the stroke of the burring heads, and change the liner and feed track of the hopper unit. After the burring or chamfering operation is completed, the heads withdraw and the pick-up cam indexes, bringing another part into the burring position and dropping the completed part into a tote pan below the machine. 87

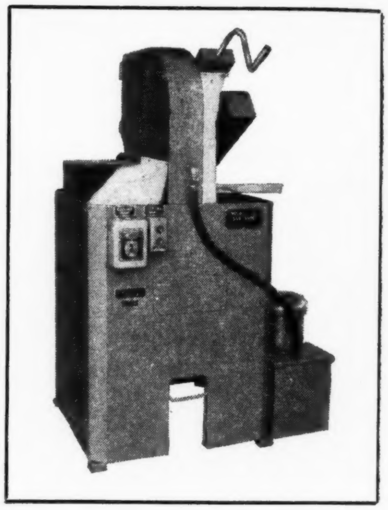


Burring and chamfering machine brought out by the Walsh Specialty Co., Inc.

Campbell Abrasive Cutting Machine

The Campbell Machine Division, American Chain & Cable Co., Inc., 925 Connecticut Ave., Bridgeport 2, Conn., has just announced a new low-cost Model 15 abrasive cutting machine. This machine is available with either a 3- or a 5-H.P. motor, and can be arranged for wet or dry cutting. It is suitable for general-purpose work, and will cut tubes, angles, and bar stock with a minimum of burr by the use of a properly selected abrasive wheel.

The machine is adapted for cutting ferrous or non-ferrous material, including corrosion resisting steels and hardened or annealed steels. Light-wall tubing up to 1 1/2 inches in diameter and solid bar stock up to 3/4 inch in diameter can be cut with the machine having a 3-H.P. motor. Light-wall tubing up to 2 inches in diameter and solid bar stock up to 1 inch in diameter can be handled on the machine equipped with a 5-H.P. motor. 88



Campbell wet or dry type abrasive cutting machine

"Tru-Steel" Shot for Blast Cleaning

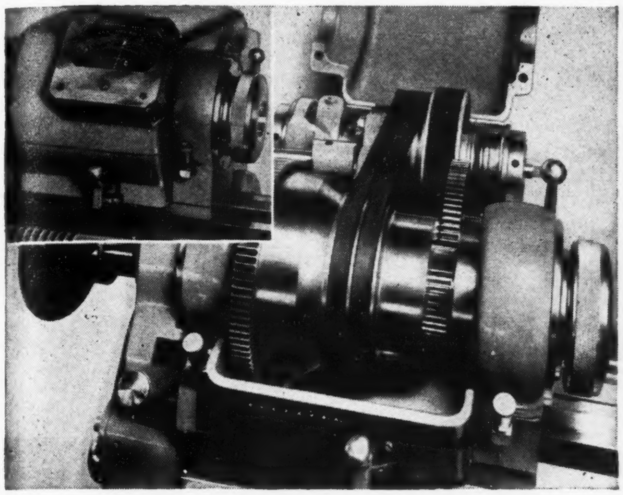
The American Wheelabrator & Equipment Corporation, 719 Byrkit St., Mishawaka, Ind., has announced a new product known as "Tru-Steel" shot, which has been developed for use in all types of blast cleaning equipment. The life of this shot is said to be much longer than that of chilled iron. Since it wears down and does not break down, there is no possibility of fragments becoming embedded in soft work. Greatly reduced wear on the blast cleaning equipment, fewer repairs, and less time required for maintenance are said to be other advantages of this new product, which is available in all sizes. 89

Wade Lathe Equipped with Stepless Speed Drive and Tachometer

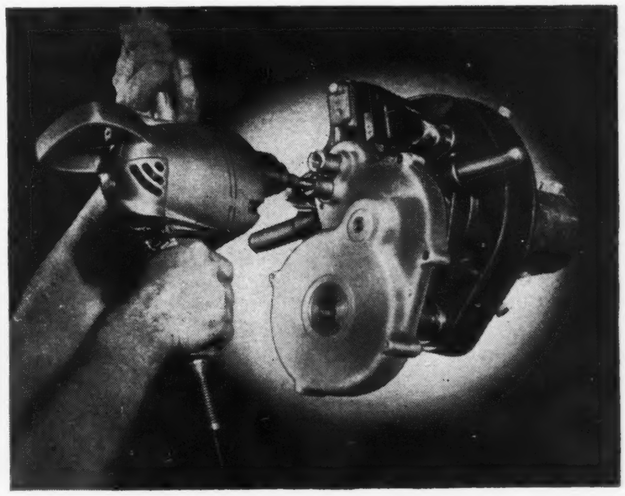
An improved toolmaker's precision lathe of 1-inch collet capacity and 8 1/2-inch swing with stepless spindle speeds ranging from 32 to 2000 R.P.M., has been designed by the Wade Tool Co., Waltham, Mass. With the back-gears engaged, a stepless spindle speed range of 32 to 220 R.P.M. is available.

The variable-speed drive has an electric tachometer located on the face of the headstock housing, as shown in the illustration, which

To obtain additional information on equipment described on this page, see lower part of page 234.



Wade lathe with stepless variable-speed drive and spindle-speed tachometer



Portable pipe-threader recently brought out by the Muncie Gear Works, Inc.

registers all spindle speeds. This drive is entirely mechanical, and is so designed that the spindle speed can be changed while the machine is running. No damage will occur, however, if the operator attempts to change the spindle speed when the motor is stopped. A clutch is incorporated in the drive that permits the operator to start and stop the spindle and apply the brake while the motor is running.

The lathe is driven by a 1-H.P. motor, all controls being protected by being mounted in an enclosed panel. Ample torque is provided for low spindle speeds by the 9 to 1 back-gear ratio. High spindle speeds are obtainable by the matched V-belts on the open drive. All countershafts of the variable-speed drive are equipped with ball bearings, permanently sealed with lubricant. 90

Portable Pipe-Threading Equipment

New portable pipe-threading equipment designed to save time and energy in threading pipe is being manufactured by the Muncie Gear Works, Inc., Muncie, Ind. This equipment, called the "Porta-Drive," fits into the average toolbox and weighs only 14 pounds. With it, one man can thread pipe up to 6 inches in size in a horizontal, vertical, or angular position, using any standard thread-cutting die-head. The "Porta-Drive" has a 20 to 1 gear reduction unit, which can be driven by a 1/2-H.P. heavy-duty electric drill, and can be adapted to any set of dies by specially designed adapter yokes. The aluminum casing houses the bull gear and cold-rolled spur gears, all of which are sealed in grease.

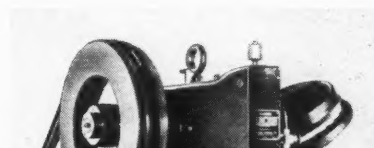
The drive facilitates threading in close quarters, as in corners or near walls. It is not necessary to remove broken pipe when threading it with this equipment. After the threading operation is completed, insertion of the drill head in the "reverse" drive socket enables the die to be quickly removed. 91

Tomkins-Johnson Underfeed "Clinchors" for Automatically Setting Nuts

An underfeed "Clinchor," available in a standard model with vertical anvil and anvil guide, and a special model with inclined anvil and anvil guide, has been announced by the Tomkins-Johnson Co., Jackson, Mich. The new special Clinchors are designed to automatically feed and set standard square-neck cased nuts, and can also be furnished for handling floating type cased nuts and various sizes of "Fabri-Steel" nuts.

The standard underfeed Clinchors have advantages in flexibility, being capable of handling a greater variety of sizes and types of nuts than the inclined-anvil models. The inclined anvil and anvil guide make it possible to use the special Clinchors for setting nuts in certain parts that could not be handled on the standard model because of restricted clearances in the parts.

With these machines, the nuts are fed from underneath the work, so that there is no transfer ram to interfere with removal of the part after each nut is set. The operator simply loads clinch nuts in a hopper at the top of the machine which feeds them by means of an underfeed mechanism to the anvil. In operation, the part is placed in the machine and properly located with the clinch



Tomkins-Johnson underfeed "Clinchor" with inclined anvil and anvil guide

To obtain additional information on equipment described on this page, see lower part of page 234.

INCREASE PERCENTAGE OF GRINDING TIME

with these

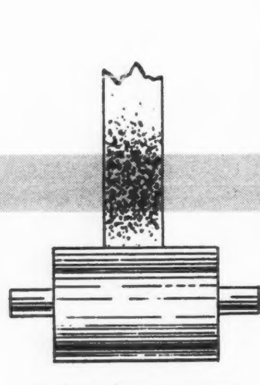
2 ADVANCE-DESIGN AUTOMATIC CYCLE ARRANGEMENTS

THE NEW Automatic Cycle and Spark-Timing Arrangement and the new Automatic Cycle and Sizing Arrangement make Brown & Sharpe Plain Grinding Machines even more productive and versatile. They assure extremely-rapid uniformity of sizing and finish, practically full-time grinding, a minimum of rejects . . . with less effort and attention from the operator.

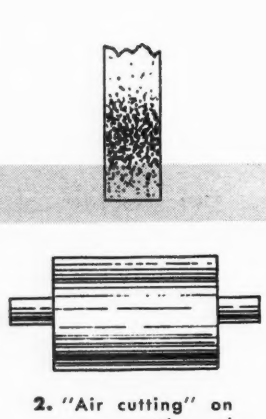
A UNIQUE FEATURE common to both Arrangements is the *direct-contact wheel-to-work manual infeed* at the start of the cycle. This feature permits larger work tolerances in preceding operations. It eliminates the need of set-ups that favor the high limit of previous turning tolerances. Non-productive time is out . . . no "air-cutting" —net result, appreciably lower overall machining cost.

ANOTHER IMPORTANT FEATURE common to both arrangements is *ease of disengagement*, whereby the machines are instantly available as standard plain grinding machines.

Investigate these new opportunities to reduce your grinding costs still further. Highlights of each arrangement given on opposite page. Arrangements available on all Brown and Sharpe Plain Grinding Machines. Write for complete details. Brown & Sharpe Mfg. Co., Providence 1, R.I., U.S.A.



1. Immediate contact with work.



2. "Air cutting" on conventional machines with automatic cycle.

These two diagrams show the advantage of Brown & Sharpe infeed over conventional automatic cycle infeeds. **1.** Brown & Sharpe infeed brings grinding wheel into immediate contact with work by a continuous smooth sweep of handwheel . . . provides initial grind before cross-feed pawl is engaged. **2.** With conventional infeed, wheel must approach work on slow feed.

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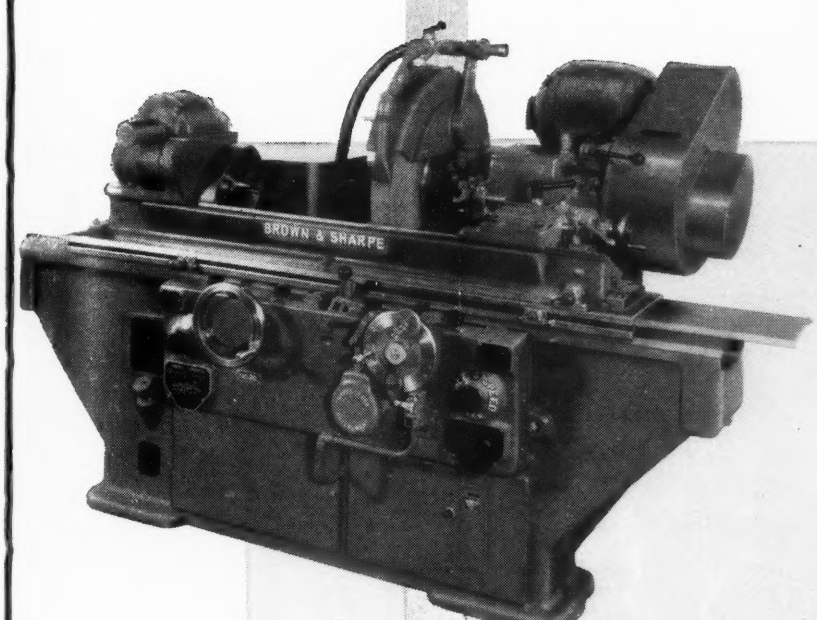


No. 22 Plain Grinding Machine with Automatic Cycle and Spark-Timing Arrangement.

No. 10 Plain Grinding Machine with Automatic Cycle and Sizing-Arrangement.

AUTOMATIC CYCLE AND SPARK-TIMING ARRANGEMENT

On plunge-cut or transverse grinding where uniformity of sizing and finish is essential, this arrangement automatically controls spark time and operation at a predetermined rate (spark time adjustable from 2 to 180 seconds). After grinding is completed, wheel slide withdraws automatically, headstock stops and coolant is shut off. Arrangement used with reciprocating table employs normal amount of spark time allowed for traverse grinding without automatic cycle. Handwheel operation provides positive protection against automatic cycle starting accidentally.

AUTOMATIC CYCLE AND SIZING ARRANGEMENT

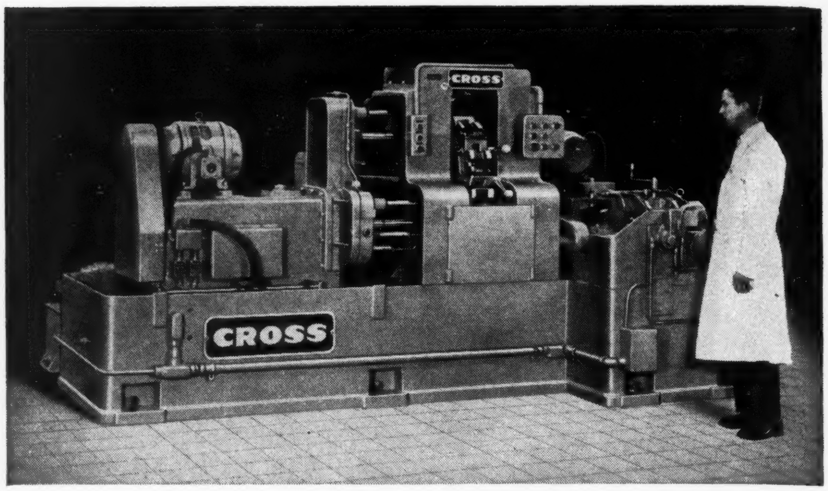
For longer production runs on plunge-cut grinding, where uniform sizing and finish to .0001″ are desired, this arrangement offers maximum output at minimum cost and effort. It automatically sizes from the work—eliminates compensating for wheel wear and effects of wheel truing. After loading and three simple hand operations, cycle is completed automatically. When wheel approaches within .001″ to .003″ (pre-set on work sizing gage) of finish size, cycle changes from coarse feed to predetermined fine feed.

THESE TWO NEW ARRANGEMENTS NOW AVAILABLE on the following Brown & Sharpe Plain Grinding Machines: No. 5—Nos. 10 & 12—Nos. 20, 22 & 23.

SHARPE BS

nut in the hole in the part. Next, the operator presses the foot-pedal, causing the ram to descend and set the clinch nut firmly in the part. The underfeed mechanism then instantly reloads the anvil, ready for the next operation. The machine is fully automatic and extremely rapid in operation.

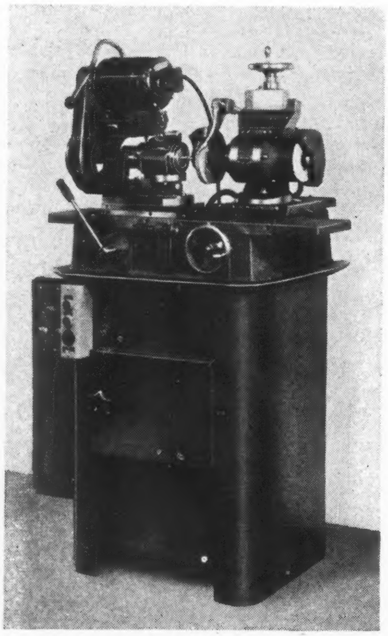
The standard machine handles clinch nuts with outside diameters from 9/16 to 3/4 inch and square case type clinch nuts from 17/32 to 29/32 inch. The throat depth range is from 8 to 36 inches. 92



Crankshaft finishing machine built by The Cross Company

Motorized Radial-Relief Grinder

A new model motor-driven radial-relief tool grinder, designed for economical volume grinding of production tools, has been placed on the market by the D-S Grinder Division, Royal Oak Tool & Machine Co., 621 E. Fourth St., P. O. Box 111, Royal Oak, Mich. A General Electric Thymotrol unit provides the drive, giving a stepless speed control having a range of 18 to 150 R.P.M. under dial control. A self-contained coolant system, with tank and pump, is included. The motor drive does not interfere with the regular mechanical operation of the fixture. Cams for tools having from one to fourteen flutes can be readily interchanged on the machine, as can the collets. 93



Radial-relief grinder brought out by D-S Grinder Division, Royal Oak Tool & Machine Co.

Special Machine for Finishing Refrigerator Crankshafts

An automatic indexing trunnion type machine has been designed by The Cross Company, Detroit 7, Mich., to complete five drilling and two milling operations on refrigerator crankshafts at the rate of 145 per hour. Only one operator is required, who simply loads and unloads the work. Two deep oil-holes are drilled progressively. The two milling operations are performed independently by an automatic unit. The standard Cross sub-assemblies of this machine can be easily rearranged to suit changes in product design and to permit easy maintenance. Features include hydraulic feeds and automatic push-button working cycle. 94

Bokum Boring and Threading Tool Holders

A new holder having the unique feature of vertical adjustment has just been developed by the Bokum Tool Co., 14775 Wildemere Ave., Detroit 21, Mich., to accommodate its large size boring and threading tools. The new holder has a conveniently located screw which provides quick and accurate vertical adjustment for boring or internal threading tools. It is bored to take shanks 1 1/2 inches in diameter, and with split bushings will hold shanks as small as 1/2 inch. Smaller tools require a special adapter.

The top of the holder, as shown in Fig. 1, has a finish-ground gage pad, located exactly 1.375 inches above the center of the bore, which facilitates making accurate height adjustment. This pad provides the reference surface for making both of the adjustments required in setting up helically backed-off boring tools, and is useful in making adjustments for taper boring or threading.

The company has also brought out a boring tool holder intended for use on only one lathe, to which it is permanently attached. This holder, shown in Fig. 2, has a fixed height. It has a bored hole 1 1/2 inches in diameter which accommodates large size shanks and adapters for tools with small shanks. 95

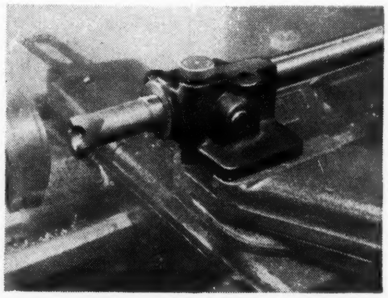


Fig. 1. Bokum boring tool holder with height adjustment

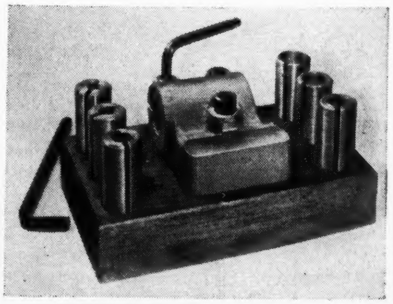
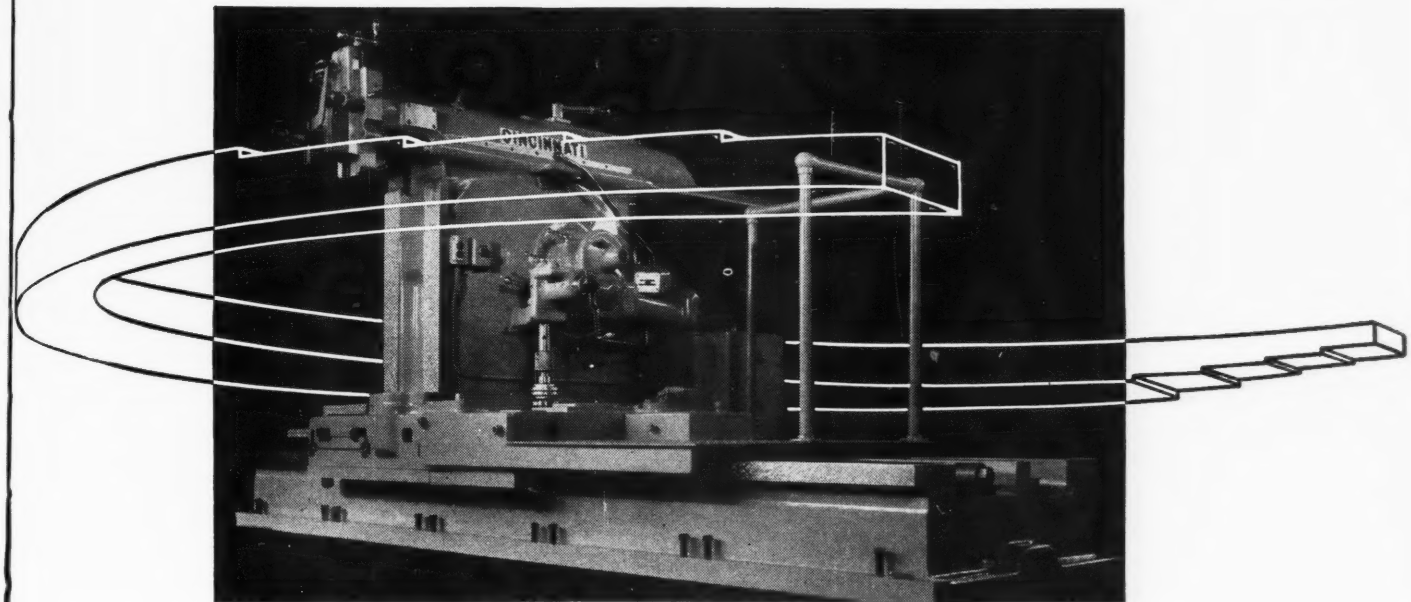


Fig. 2. Bokum boring tool holder intended for one specific lathe

To obtain additional information on equipment described on this page, see lower part of page 234.

8 ft. OF CROSS FEED

ON THIS CINCINNATI SHAPER



ONE SETUP SAVES TIME. Seven feet at end of 20-foot diameter cast steel generator half rings is machined with one setup as shown in schematic sketch above.

NEW! This new Cincinnati Traveling Shaper accurately machines surfaces requiring eight feet of table travel—with one setup.

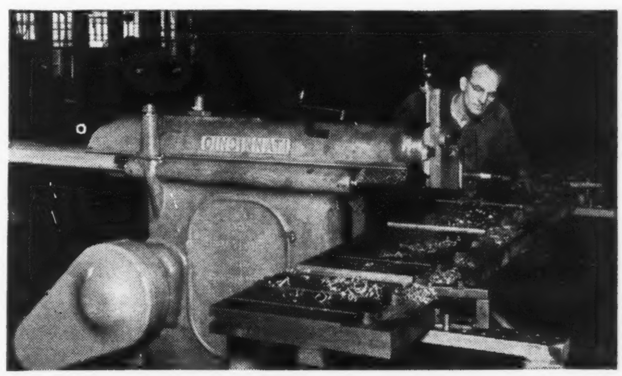
The operator rides with the machine so controls are always at hand. Accurate settings can be made easily at any point of travel with the vernier.

NEW ECONOMIES! This Cincinnati Traveling Shaper is effecting real economies for a large manufacturer of motor generators.

Steps are machined over a seven-foot length on the ends of seven-ton generator rings 20 feet in diameter. This one setup greatly reduces machining time on this otherwise awkward job.

NEW FIELDS! This application of powerful Cincinnati Shapers opens up new fields of use in the machining of long, interrupted surfaces on very large work.

Investigate the possibilities for you in this new Shaper development. Our Engineering Department will be glad to cooperate.



MANY APPLICATIONS, such as shaping slots in eight-foot table, are performed quickly and economically with a Cincinnati Traveling Shaper.

Write for the new Shaper Catalog—S-5.

THE CINCINNATI SHAPER CO.

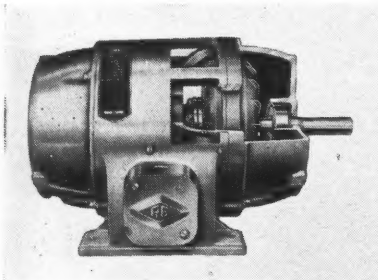
CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

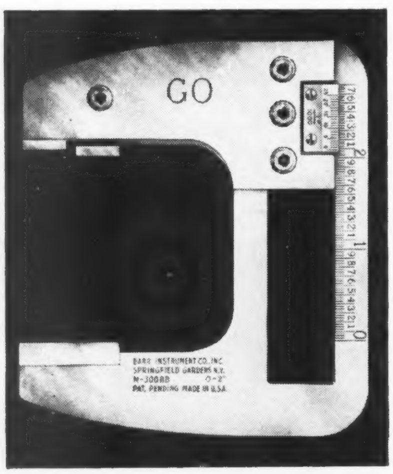
CINCINNATI

Reuland "Fluid Shaft" Electric Motors

"Fluid Shaft" electric motor unit with single-frame integral design of motor and fluid driving coupling, announced by the Reuland Electric Co., Alhambra, Calif. Developed to obtain savings in



original cost and in mounting area. Advantages include smooth acceleration, protection from jamming and shocks, and high starting torque. Available in standard foot-mounted or round-body frames for horizontal or vertical mounting or with NEMA flange and face type end bells. The units are made in nine sizes ranging from 1/2 to 10 H.P. 96

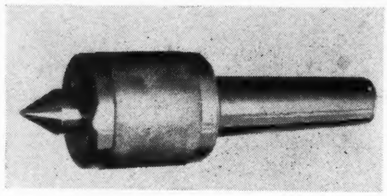


Self-Setting Wide-Range Snap Gages

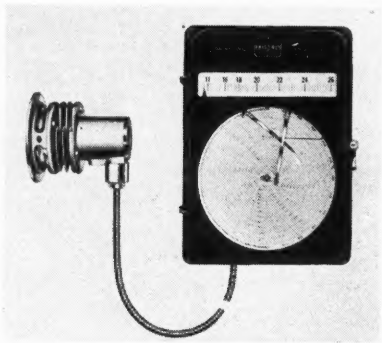
Precision self-setting snap gage made in six size ranges from 0 to 1 inch up to 3 to 6 inches, with engraved slides, as shown, or without the scales for setting with size blocks, as desired. The engraved scales read to 0.001 inch, and the 3/8-inch wide anvils are accurately aligned. Made by the Barr Instrument Co., Inc., 134-39 225th St., Springfield Gardens 13, N. Y. 97

Ball-Bearing Live Center

Ball-bearing live center designed to eliminate burning and regrinding and to permit handling heavy work with thrust loads up to 60,000 pounds. The point is made of tool steel and is hard-

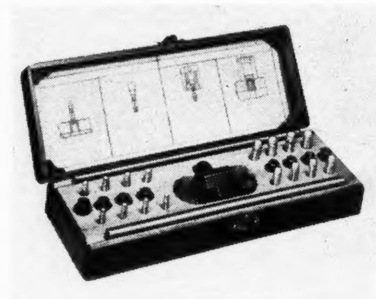


ened and ground. Concentricity is assured by grinding the shank and center point on a special jig. Available in twelve different standard models and twenty-five semi-standard models. Can also be made to suit special requirements. Introduced by Montgomery & Co., 53 Park Place, New York 7, N. Y. ..98



Bristol Radiation Pyrometer

Radiation pyrometer, known as "Pyrovisor," designed for indicating, recording, or controlling temperatures up to 4000 degrees F. in furnaces and kilns. The temperature-sensitive head mounted outside the furnace away from the hot zone picks up radiant energy emitted from the surface of the object under measurement, giving actual surface temperature measurements of the work with 99 per cent response to temperature change within one second. Made by Bristol Co., Waterbury, Conn. 99

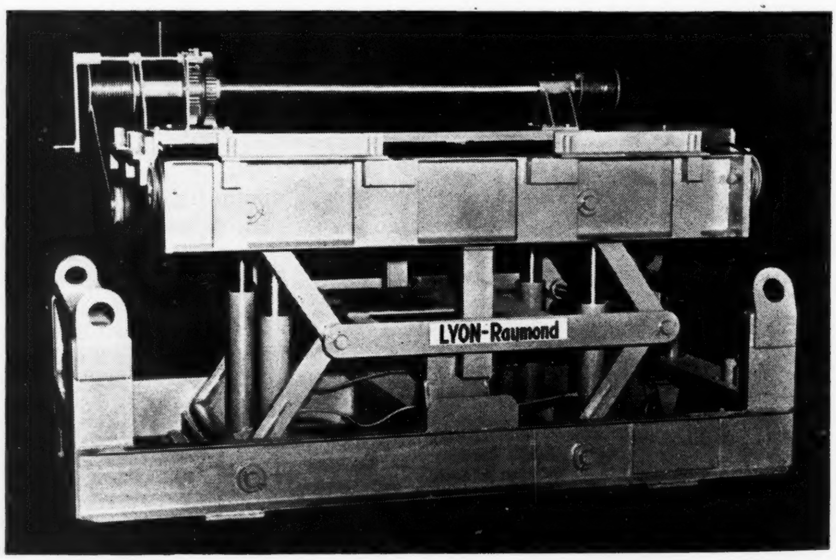


"E-Z-Pul" Piercing Die "Button" Extractor

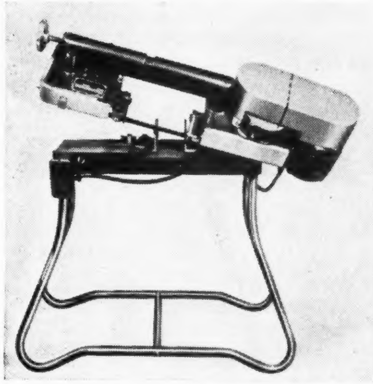
"E-Z-Pul" piercing die "button" extractor set announced by L. C. Ball Associates, Inc., 2276 AW National Bank Bldg., Detroit 26, Mich. Only four simple steps are required to remove straight or tapered hole inserts without taking the dies or die sections from the press. Also useful for removing bearings, bushings, liners, and sleeves. Two standard sets are available for inserts from 0.2031 to 0.7031 inch. Special extractors can be designed to meet individual requirements. 100

Heavy-Duty Hydraulic Die-Handling Truck

Hydraulic die-handling truck with four lifting cylinders, motor-driven hydraulic pump, provision for inserting and removing die slings, hand winch, retractable wheels and roller top. Capacity is 20,000 pounds, and elevation range from 28 to 44 inches. Four synchronized hydraulic hoists raise and lower the platform by means of push-button controls which operate solenoid valves in the power-driven pump. The dies are transported to and from die storage by means of an overhead crane. Placed on the market by the Lyon-Raymond Corporation, 7451 Madison St., Greene, N. Y. 101



To obtain additional information on equipment described on this page, see lower part of page 234.



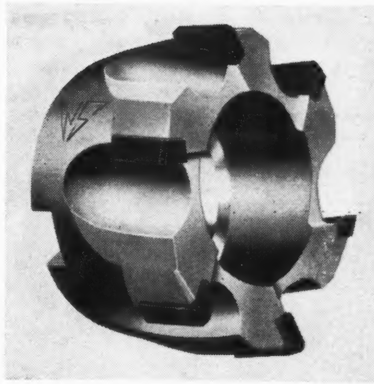
Wells Band Saw

Small-sized low-priced metal-cutting band saw built by the Wells Mfg. Corporation, 404 S. Grant, Three Rivers, Mich. Has a capacity for cutting 3 1/2-inch rounds and 3 1/2- by 6 5/8-inch rectangular shapes. Blade is 1/2 by 0.025 inch by 5 feet long, and is driven by a 1/6-H.P. ball-bearing motor with manual start and automatic stop. A V-belt drive provides selective speeds of 54, 100, and 190 feet per minute. Floor space required, 16 1/2 by 38 inches..102

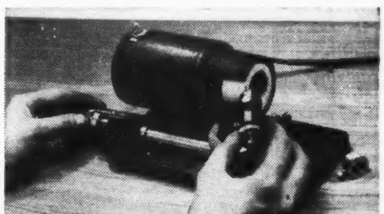
Contour Projector

Miniature optical contour projector adapted for bench and belt inspection operations. Developed by Stocker & Yale, Marblehead, Mass. Totally enclosed screen allows projector to be used anywhere and at any time without interference from surrounding lighting conditions. Standard magnifications are 120, 90, 60, 45, and 30. Screen size is 6 inches square, and field covered at any magnification can be calculated by dividing magnification value into 6 inches. A staging fixture is usually employed for rapid and extremely accurate gaging. 103

Wendt-Sonis Shell End-Mill

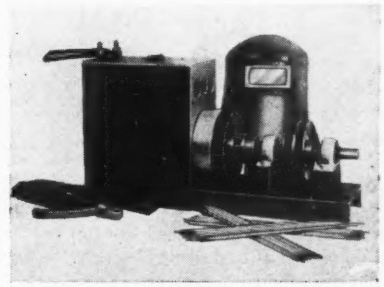


New type shell end-mill developed by the Wendt-Sonis Co., Hannibal, Mo., for facing or milling to a shoulder. The large number of teeth permits increased table feeds and provides free cutting action. The cutters have ample flute capacity for proper chip removal and a contour that insures correct chip formation. The carbide inserts have sufficient overhang to prevent the diamond wheel from touching the steel body of the cutter when regrinding. Available in sizes from 1 1/2 to 6 inches. 104



Small Cutter Grinder

New small-sized cutter grinder available from the Green Instrument Co., 385 Putnam Ave., Cambridge, Mass. Designed to enable an inexperienced worker to sharpen small engraving cutters accurately after only a few minutes practice. The grinder occupies a bench space of only 6 by 12 inches. Standard cutter-head takes the Green Instrument Co.'s tapered-shank engraving cutters, but can be supplied in other tapers with collets for handling straight-shank cutters. The hand-operated in-feed is graduated to 0.001 inch. Equipped with motor having a shaft extended at both ends for mounting a buffing wheel in addition to the grinding wheel. 105

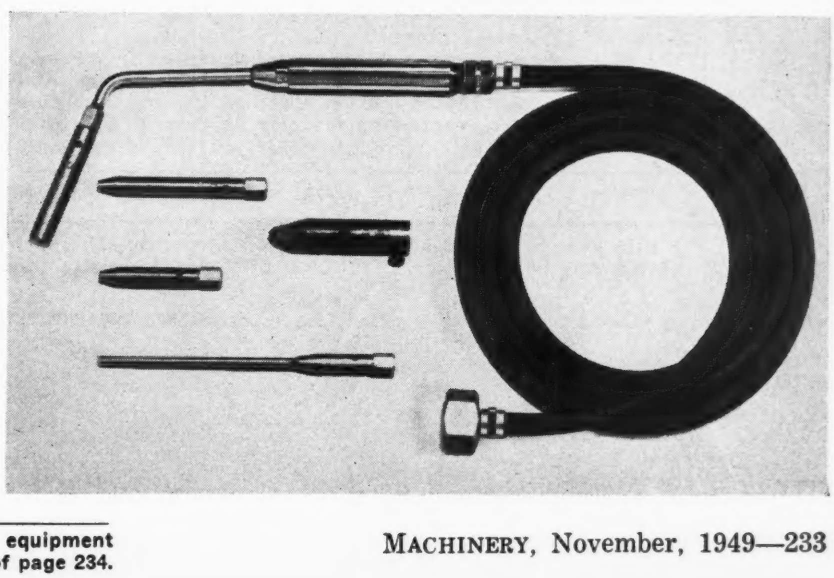


Groban Arc-Welder

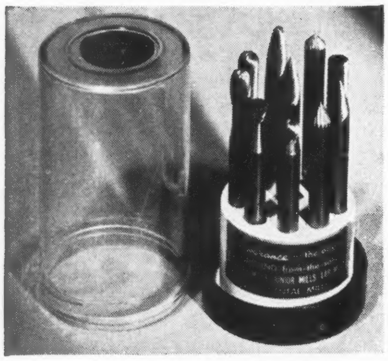
Arc-welder with continuous welding rating of 200 amperes and intermittent rating of 250 amperes. Placed on the market by the Manufacturing Division, Groban Supply Co., 1507 S. Michigan Ave., Chicago 5, Ill. This Model 202 arc-welder is designed for welding sheet metal from the light gages up to 1/4 inch thick plate, using 1/16 to 1/4 inch welding rods. Can be operated at 2500 R.P.M. by drive pulley of tractor, by a 7 1/2-H.P. motor, or by a 10-H.P. gas engine. 106

Airco Air-Acetylene Outfit

Airco No. 75 air-acetylene outfit for small soldering, low-temperature brazing, heating, or lead-burning jobs. It is available with four tips — a radiator soldering tip with slender tubing which permits the flame to be used in confined places; a tip for use when a medium flame is required; a tip that produces a pointed flame suitable for concentrated heating; and a tip that gives a brush type flame adapted for heating broad areas. The torch assembly, five feet of 3/16-inch flexible hose, soldering iron, and soldering copper complete the outfit. Announced by Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y. 107

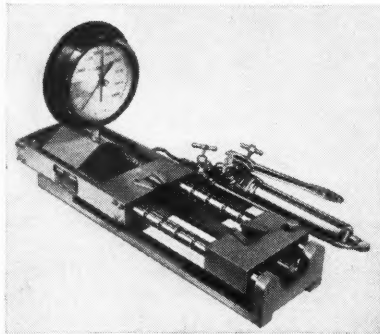


To obtain additional information on equipment described on this page, see lower part of page 234.



Severance "Carbo-Mills"

Set of 1/4-inch shank solid carbide "Carbo-Mills," including the ten most popular shapes, furnished in a "Visi-Case." Recently added to the line of "Carbo-Mills" made by the Severance Co., 636 Iowa St., Saginaw, Mich. These tools are designed to withstand more abuse than is ordinarily given carbide tools and to operate satisfactorily at speeds lower than those generally employed for similar carbide cutters. Especially adapted for removing gates, fins, and risers; breaking sharp corners and edges; machining carbon; finishing castings of any material; grinding radii and grooves; deburring oil-holes; blending welds and assembled parts; and removing weld beads 108

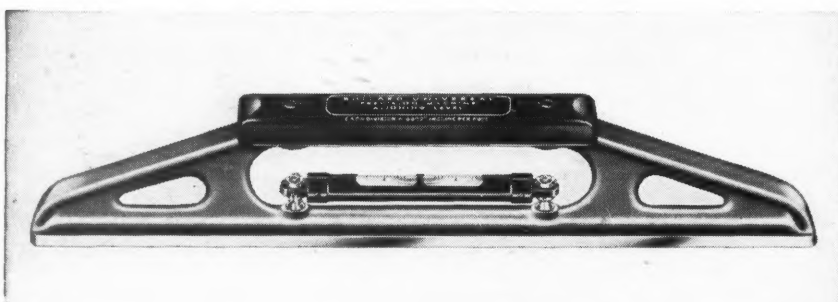


Tensile Testing Machine

Portable tensile testing machine for making field tests where conventional testing equipment is not available. While this Model PO-40 tester is particularly adapted for testing pipe and other welds in the field, its high degree of accuracy also makes it satisfactory for use in laboratory and shop testing. The machine has a capacity of 40,000 pounds, and will make tests on specimens from 6 to 13 inches long and up to 3/8 inch thick and 2 1/4 inches wide. It is hydraulically operated by means of a hand pump integral with the base. Available from Steel City Testing Machines, Inc., 8843 Livernois, Detroit 4, Mich. 110

Bullard Universal Precision Aligning Level

Precision level for aligning machines, manufactured by the Bullard Co., Bridgeport 2, Conn. The optical glass vial is specially ground and is mounted on two brass studs with adjustments similar to those used on precision surveying instruments. The bubble in the vial has a guaranteed sensitiveness of five seconds of arc per graduation, which is equivalent to a variation of only 0.0003 inch per foot. Made in lengths of 18 and 27 inches. 109



Schatz Precision Clutch Release Ball Bearing

Precision clutch release ball bearing for industrial and automotive applications, manufactured in a wide range of sizes and in both angular contact and thrust types by the Schatz Mfg. Co., Poughkeepsie, N. Y. The new bearing has a superfine race finish developed to prevent overheating, and a specially designed U-type cage designed to trap and retain the original grease in the raceways and to supply efficient lubrication to the rotating balls without leakage. 111

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in November, 1949, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

NAME... **POSITION OR TITLE**...................................

[This service is for those in charge of shop and engineering work in manufacturing plants.]

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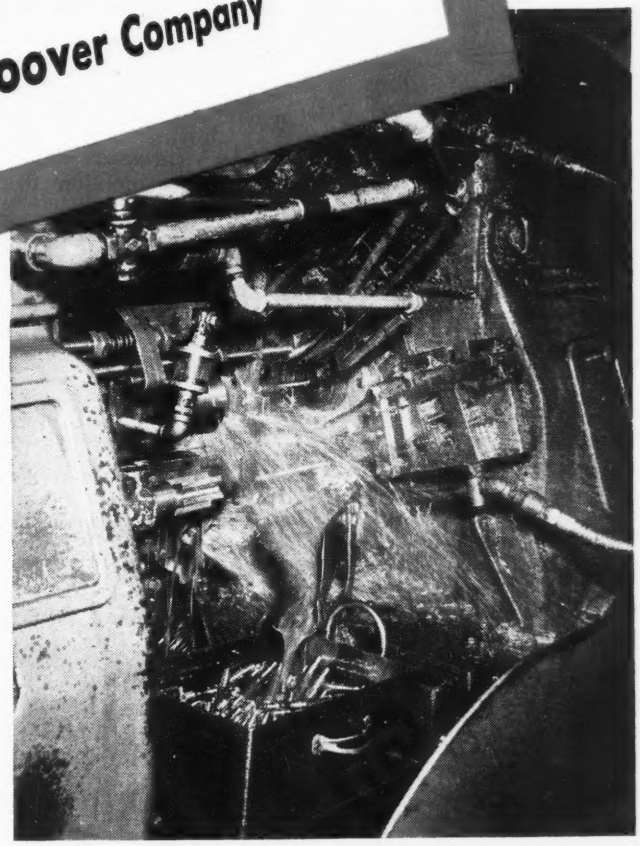
Texaco dual-purpose oil makes A Substantial Saving for the Hoover Company



Motor shafts for the famous Hoover Electric Cleaners are produced on this 9/16-inch Acme Gridley automatic screw machine. *Texaco Cleartex Cutting Oil* serves as both cutting coolant and machine lubricant.

In the North Canton, Ohio, plant of The Hoover Company, pioneer maker of electric cleaners, the machining operation illustrated formerly required two lubricants – one for the machine, the other for the cutting tools. End result was contaminated oil that had only scrap value.

A Texaco Lubrication Engineer recommended *Texaco Cleartex Cutting Oil,* designed to serve as both cutting coolant and machine lubricant. *"By using this dual-purpose oil,"* says The Hoover Company, *"the used oil can now be salvaged at a substantial saving."* In addition, *Cleartex* keeps machining efficiency high, assures excellent finish, prolongs tool life.

Texaco Cleartex Cutting Oil is only one of a complete line of Texaco Cutting, Soluble and Grinding Oils designed to do machining jobs better, faster, at lower cost.

Let a Texaco Lubrication Engineer specializing in machining operations help you achieve these benefits on all your metal working. Just call the nearest of the more than 2300 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

TEXACO REG. T. M.

TEXACO CUTTING, GRINDING AND SOLUBLE OILS FOR FASTER MACHINING

New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 240 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the November, 1949, Number of MACHINERY

Ball Bearing Interchangeable Tables

MARLIN-ROCKWELL CORPORATION, Jamestown, N. Y. Bulletin 26, containing a list of bearing numbers of 12,500 ball bearings of various makes and the corresponding M-R-C ball bearing replacement numbers. The bearing numbers for each manufacturer are arranged numerically, so that any particular number can be readily found. 1

Plastic Sheets, Tubes, and Molded Parts

FORMICA CO., 4613 Spring Grove Ave., Cincinnati 32, Ohio. Catalogue entitled "Productive Formica at Work in Industry" describing the various industrial applications of this laminated thermosetting plastic, and giving a chart listing comparative properties of fifty different grades. 2

Retaining Rings for Seal and Shield Bearings

WALDES KOHINOOR, INC., Department TR58, Long Island City 1, N. Y. Charts giving engineering data and specifications for use of Waldes Truarc inverted retaining rings with seal and shield bearings, including Fafnir, Federal, Hoover, New Departure, and MRC types. 3

Centralized Lubrication System

FARVAL CORPORATION, 3293 E. 80th St., Cleveland 4, Ohio. Bulletin 15, describing the construction and installation of the Farval "Multival" lubricating system, designed to deliver measured amounts of lubricant under high pressure from a single grease-gun connection to a group of bearings. 4

Flexible Sheet-Metal Operations

HYDRAULIC PRESS MFG. CO., 1042 Marion Road, Mount Gilead, Ohio. Reprint of an article "Flexibility of Sheet Metal Operations," describing production runs of tractor components ranging from 500 to 2000 pieces, involving fifty-two parts and ninety-six different operations. 5

Metal- and Wood-Working Machines

WALKER-TURNER DIVISION, KEARNEY & TRECKER CORPORATION, Plainfield, N. J. Catalogue B, illustrating and describing the line of smaller machine tools made by the company for metal- and wood-working operations, including four new models. 6

Steel Plate and Sheet Cutting Machines

AMERICAN PULLMAX CO., INC., 2627 N. Western Ave., Chicago 47, Ill. Folder describing the new Pullmax sheet-steel and plate cutting machine, which is made in seven different sizes for cutting steel from the lightest gage up to 11/32 inch thick. 7

Grinding and Polishing Metal Strips and Blanks

CURTIS MACHINE DIVISION, LINCOLN PARK INDUSTRIES, INC., Jamestown, N. Y. Leaflet descriptive of the new Curtis 600 "Straight-O-Matic" for grinding and polishing flat metal strips and blanks up to 10 inches in width...8

Motorized Centers

MOORE SPECIAL TOOL CO., INC., Bridgeport 7, Conn. Catalogue showing twenty different applications of Moore motorized centers, a grinding attachment designed for use on surface grinders, jig borers, jig grinders, drill presses, and light milling machines. 9

Chart of Hard-Facing Rods and Electrodes

AMERICAN BRAKE SHOE CO., 230 Park Ave., New York 17, N. Y. Bulletin CC-3, containing a new selector and comparison chart of hard-facing rods and electrodes, indicating the type of service for which each is designed. 10

Fabricating and Finishing Zinc-Coated Sheet Steel

ARMCO STEEL CORPORATION, 1049 Curtis St., Middletown, Ohio. Booklet describing recommended methods of forming, joining, and painting Armco "Zincgrip-Paintgrip"—a special zinc-coated and bonderized sheet steel. 11

Arc-Welding Accessories

GENERAL ELECTRIC CO., Schenectady 5, N. Y. Bulletin GEC-253A, containing descriptions, specifications, and prices of more than 150 arc-welding accessories, including electrodes and holders, torches, helmets and goggles, protective clothing, etc. 12

Vibration Control Equipment

WESTERN FELT WORKS, 4029 Ogden Ave., Chicago 23, Ill. Booklet entitled "Westsorb Vibration Absorbing Felt for Machine Mountings," showing applications of Westsorb mounting pads for

SHEET No. 107

GEAR PRODUCTION HIGHLIGHTS

Cutting-Shaving-Checking-Lapping

MICHIGAN TOOL COMPANY
7171 E. McNICHOLS RD. • DETROIT 12, MICH.

New Production Line Gear Shaver For Heavy Duty Gears

Designed as a PRODUCTION machine, the new Michigan Model 873 rotary gear shaver (Fig. 1) brings to the finishing of heavy duty gears the ability to turn out such gears faster, more accurately and at lower cost. Completely automatic in operation, the 873 will handle spur or helical gears and involute splines of from zero (with 10″ cutter or larger) to 18 or 24 in. diameter, and with face widths ranging up to 15 in. Once the machine is set up for a given gear type, it is necessary only to load the gear between centers and push a 'start' button to complete the entire operation.

Features of the new Michigan 873 include ability to shave gears by any of three methods—

1. UNDERPASS—(Fig. 2) tangential feed; one roughing and one finishing pass usually enough for any gear (up to 4″ face). For finishing close shoulder gears, etc.; evenly distributed cutter wear.
2. TRAVERPASS—(Fig. 3) combined tangential and axial feed of the cutter. Evenly distributed cutter wear; cutters narrower than underpass. (Gears up to 5″ face)
3. TRANSVERSE—(Fig. 4) infeed; rapid approach plus a slower intermittent infeed. For finishing widest face gears (up to 15″ face) with narrow cutters.

Curve Shaving. Ability to curve-shave (crown) either narrow or wide face gears by any of the above three methods. Adjustable power-driven sine-bar mechanism rocks the work table about a center pivot for transverse and some traverpass shaving. Others curve-shaved by use of reverse-crowned cutters.

Floor Space. Greatly reduced compared with previous machines designed for handling large gears.

Controls. All controls located at front of machine.

Faster Cutting, due to inclusion of a 'rapid approach' feed in the machine cycle, and automatic in-and-return feed.

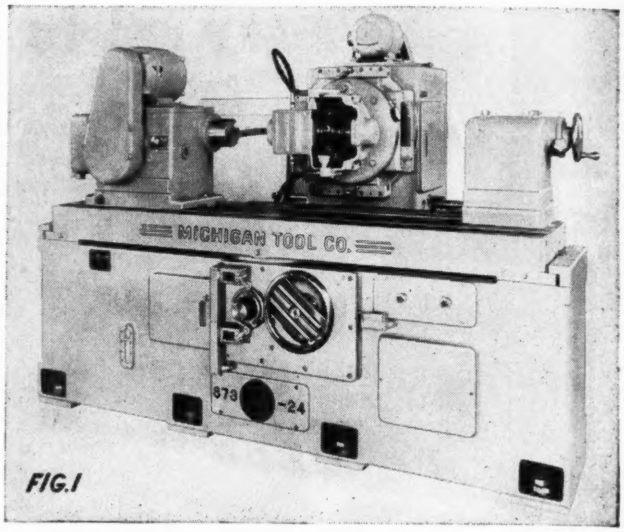


FIG. 1

Internal Gears. Special interchangeable cutter head provides for finishing internal gears on the 873.

Adjustments of the 873 have been kept simple for fast setup. Crossed axis setting is speeded by adding a five ten-thousandths indicator to the conventional vernier arrangement. Any of the three shaving methods may be selected by rotating the slide for the cutter head into proper position, mounting the correct cutter, adjusting center distance (by hand wheel at front of machine), and setting machine cycle. Limit switches regulate cutter reciprocation and head infeed.

Specifically designed for production line operation, the machine enables the use of unskilled or semi-skilled operators, further reducing costs. The operator merely loads the gear between centers and starts the machine by pushing a button. At the end of the complete machine cycle, the operator merely reloads. Machines are so designed that an overhead crane or hoist can be used to lower heavy gears directly between the centers.

For further information on the new 873 gear shaver, ask for Bulletin No. 873-49.

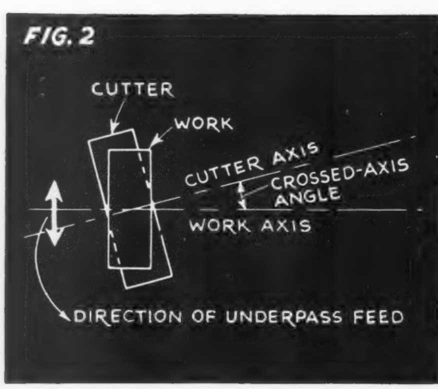


FIG. 2

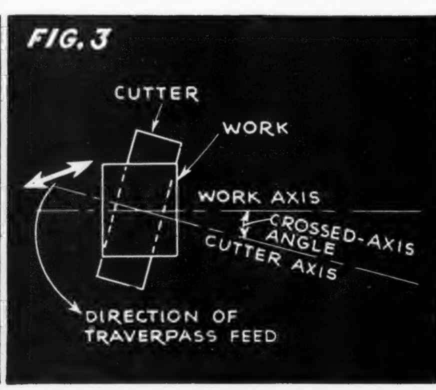


FIG. 3

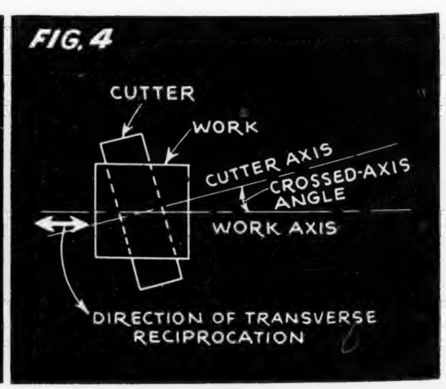


FIG. 4

reducing vibration in various production fields. 13

"Autofeed" Presses

DANLY MACHINE SPECIALTIES, INC., 2100 S. 52nd Ave., Cicero 50, Ill. Booklet 749, containing complete catalogue information and specifications on the Danly line of heavy-duty "Autofeed" presses for high-production stamping operations. 14

Research Laboratories

FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA, Benjamin Franklin Parkway at 20th St., Philadelphia 3, Pa. Bulletin describing the greatly expanded facilities of the Institute's research and development laboratories. 15

Force-Feed Lubricators

MANZEL DIVISION OF FRONTIER INDUSTRIES, INC., 315 Babcock St., Buffalo 10, N. Y. Catalogue 82-S, illustrating and describing the application of Manzel force-feed spray lubricators in punching and shearing operations. 16

Abrasive Segments

SIMONDS ABRASIVE CO., Tacony and Fraley Sts., Philadelphia 37, Pa. Bulletin ESA-188, on Simonds abrasive segments, including grain and grade recommendations for surface grinding and machine knife grinding operations. 17

Speed Reducers

MICHIGAN TOOL CO., CONE DRIVE DIVISION, 7171 E. McNichols Road, Detroit 12, Mich. Bulletins 8962 and 8964, describing how standard single-reduction cone-drive speed reducers are combined to give double-reduction units. 18

Single-Point, Solid-Rod Carbide Boring Tools

INDUSTRIAL CARBIDE TOOL CO., INC., 33 Hermon St., Worcester 8, Mass. Price list of single-point, solid-rod carbide boring tools, together with reference charts of boring tool applications. 19

Meehanite Castings

MEEHANITE METAL CORPORATION, Pershing Square Bldg., New Rochelle, N. Y. Bulletin 32, containing a tabular summary of the engineering properties of various Meehanite castings. 20

Conveyors

HAPMAN CONVEYORS, INC., 2405-13 W. McNichols Road, Detroit 21, Mich. Catalogue 5000, containing forty pages of information on Hapman rubber-flight pipe conveyors for handling any material, including abrasives. 21

Boring and Threading Tool Holders

BOKUM TOOL CO., 14475 Wildemere Ave., Detroit 21, Mich. Circular illustrating and describing boring and internal threading tool holders with vertical adjustment, for use in lathes. 22

Punch-Press Feeding Device

V & O PRESS CO., Hudson, N. Y. Catalogue describing the six sizes of V & O "Feed-O-Matics" for punch presses and other machine tools, recently acquired by the company from the Covert Mfg. Co., Troy, N. Y. 23

Drop-Forgings

MERRILL BROTHERS, Maspeth, New York City, N. Y. Catalogue 51, containing 30 pages of information on the line of drop-forgings and drop-forged parts produced by this company. Technical data is included. 24

Gas Cutting Machines

AIR REDUCTION SALES CO., 60 E. 42nd St., New York 17, N. Y. Folder ADC 628C, descriptive of two of the company's pantograph type gas cutting machines, known as the "Oxygraph" and the "Travograph." 25

Pre-Lubricated Bearings

WESTINGHOUSE ELECTRIC CORPORATION, P.O. Box 868, Pittsburgh 30, Pa. Booklet B-4378, containing information on the pre-lubricated bearings used in "Life-Line" motors, including case histories. 26

Precision Automatic Tapping Unit

PRECISION THREAD ENGINEERING CO., 2540 Park Ave., Detroit 1, Mich. Leaflet illustrating and describing the precision Model BT automatic tapping unit with lead-screw control. 27

Vibration Isolators

FINN & CO., 2850 Eighth Ave., New York 30, N. Y. 24-page catalogue containing data on the company's complete line of vibration isolators, including charts for selecting the right type for various machines. 28

Punch Presses

SALES SERVICE MACHINE TOOL CO., 2363 University Ave., St. Paul 4, Minn. Bulletin P849, containing specifications for the six standard models of "Press-Rite" open-back inclinable punch presses. 29

Dry Cyaniding Process of Casehardening

SURFACE COMBUSTION CORPORATION, Toledo 1, Ohio. Circular SC-145, describing the application of the dry (gas) cyaniding process of casehardening steel in continuous and batch type industrial furnaces. 30

Twist Drills and Reamers

CHARLES H. BESLY & CO., 118 N. Clinton St., Chicago 6, Ill. 48-page catalogue containing complete specifications on the company's recently introduced line of high-speed twist drills and reamers. 31

Radiation Pyrometer

BRISTOL CO., Waterbury 20, Conn. Bulletin P1242, descriptive of the new Bristol "Pyrovisor" radiation pyrometer for indicating, recording, and controlling temperatures up to 4000 degrees F. 32

Maintenance Control

REMINGTON RAND, INC., 315 Fourth Ave., New York 10, N. Y. Circular KD-449, describing a simplified visual preventive maintenance control system for plant and production equipment. 33

Induction Heaters

AJAX ELECTROTHERMIC CORPORATION, Ajax Park, Trenton 5, N. J. Bulletin 28, on Ajax-Northrup low-frequency induction heaters for die nozzles, stress relieving, shrink fits, etc. 34

Threading Stainless Steel

COOPER ALLOY FOUNDRY CO., Hillside 5, N. J. Folder containing case studies on the threading of stainless steel, including speeds, tool angles, coolants, and other pertinent data. 35

Flexible Band Knives

L. S. STARRETT Co., Athol, Mass. Catalogue containing price list and complete information on the "Fast-Kut" band knives recently added to the company's line for cutting soft materials. 36

Vibration Control

KORFUND Co., 48-39 M 32nd Place, Long Island City 1, N. Y. Bulletin LK-551, describing the Type LK "Vibro-Isolator" for vibration control of machines. Typical installations are shown. 37

Fan-Cooled Speed Reducers

CLEVELAND WORM & GEAR Co., 3276 E. 80th St., Cleveland 4, Ohio. Bulletin containing case histories of the savings effected with "Speedaire" fan-cooled worm-gear speed reducers. 38

Tool-Crib Control

MCCASKEY REGISTER Co., 101 W. 31st St., New York 1, N. Y. Booklet entitled "How Tool Costs Were Cut Twelve Ways in Twenty Plants with McCaskey Tool-Crib Control." 39

Ball and Roller Bearings

LINK-BELT Co., 307 N. Michigan Ave., Chicago 1, Ill. 112-page catalogue and engineering data book No. 2550, covering the company's complete line of ball and roller bearings. 40

Dust Control Equipment

AMERICAN AIR FILTER Co., INC., 266 Central Ave., Louisville 8, Ky. Circular describing an installation of Roto-Clone dust control equipment in a typical grinding department. 41

Grinding Chucks and Segments

STERLING GRINDING WHEEL DIVISION OF THE CLEVELAND QUARRIES Co., Tiffin, Ohio. Circular on Sterling No. 2 grinding chucks and segments. 42

Flexible Hose Assemblies

RESISTOFLEX CORPORATION, Belleville 9, N. J. Bulletin on Resistoflex synthetic solvent-proof hose assemblies for hydraulic, lubrication, chemical, and other lines. 43

Alundum Grinding Wheels

NORTON Co., Worcester 6, Mass. Circular describing the characteristics and cost-cutting possibilities of "32 Alundum" grinding wheels for all types of grinding. 44

Pneumatic Bar Feeds

LIPE - ROLLWAY CORPORATION, Syracuse, N. Y. Circular describing the features of the new Lipe fully automatic pneumatic bar feeds for screw machines. 45

Air Cylinders

BELLOWS Co., 222 W. Market St., Akron, Ohio. Bulletin PD-120, descriptive of the Bellows "Power Dome" non-rotating, double-acting air cylinders. 46

Dust Masks

MINE SAFETY APPLIANCES Co., Braddock, Thomas and Meade Sts., Pittsburgh 8, Pa. Leaflet illustrating and describing a new "All Vision" dust mask for industrial use. 47

Brazing Machines

SELAS CORPORATION OF AMERICA, Erie Ave. and D St., Philadelphia 34, Pa. Bulletin 497, describing the advantages of Selas Gradiation brazing machines. 48

Dust Collectors

AGET - DETROIT Co., Main at Washington St., Ann Arbor, Mich. 36-page catalogue and price list of unit type Dustkop dust and vapor collectors. 49

Hand Chain Hoists

HARRINGTON Co., Philadelphia 30, Pa. Bulletin P-5, descriptive of the Peerless Packet hand chain hoist, a low-priced, compact, lightweight unit. 50

Contract Manufacturing

STEARNS-ROGER MFG. Co., Denver 2, Colo. Bulletin 646, describing and illustrating the company's facilities for contract manufacturing. 51

Fractional-Horsepower Motors

FRANKLIN ELECTRIC Co., INC., Bluffton, Ind. Catalogue 102, descriptive of the company's line of fractional-horsepower electric motors. 52

Metal Cleaners

HANSON - VAN WINKLE - MUNNING Co., Matawan, N. J. Bulletin C-106, entitled "Cleaners for Effective Metal Cleaning." 53

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation), fill in below the publications wanted, using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (November, 1949) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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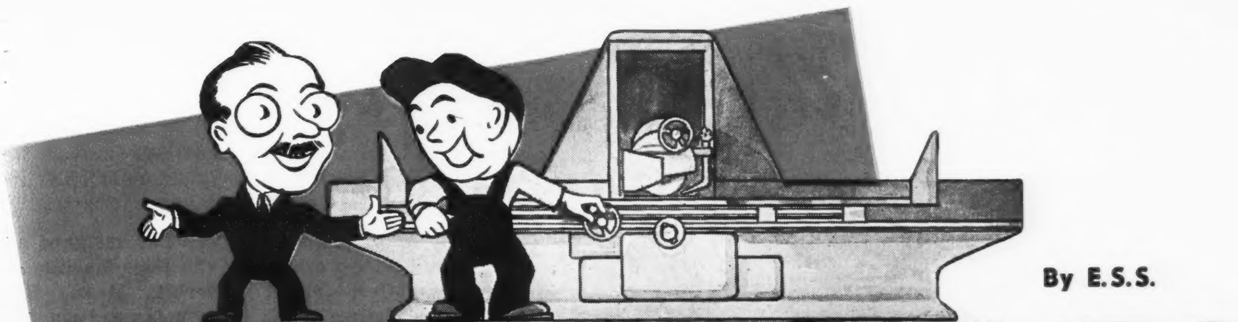


BETWEEN GRINDS

By E.S.S.

Cars and Camels

A columnist in *The New Yorker,* inspired by Buick's new front-end design in which the grille is brought forward of the bumper, took a look into the future; he visualized models with grilles protecting bumpers, then bumpers grilles, and so on, until in about the year 1957 an automobile having seven of each front and rear appeared on the scene. This hazily recalled to us the plight of the camel: Not content with one hump on a camel, nature in a flourishing evolutionary gesture put a two-humped camel on the market. Fortunately for the camel, nature was apparently diverted at these points to some other project. But to return to the columnist, is the automobile rolling into the flowering stage as well?

How Thin Can You Slice It?

Metal has been cut so thin that you can see through it. This close shave is administered by Dr. E. F. Fullam of the Research Laboratory, General Electric Co., in a machine he developed called the microtome. The slice is 0.000002 (two-millionths) inch thick—inch thin, we'd say.

When Greeks Meet

A study of the Greek labor movement by ECA has proved somewhat complex. There are 1785 unions existing in Greece, many of them simply associations of people bound together because of some injury they have experienced or mutual interest, and not related to "organized labor." Such have descriptive names: The Association of Ruined Bus Owners; The Council of Retired Lieutenant Generals; The Union of the Wronged Workers of Piraeus; and The Union of Cobweb Sweepers of Patras (those with the long brooms). Evidently you're not in the swing with a short broom.

Joke Comes Home to Roost

In the distant past, a joke particularly applicable to our office was tried on a newcomer: Spelling out MacIntosh, you asked the person to pronounce it; then MacDonald, MacDougal, etc. (prolonging this or not depending upon the gullibility of the prospect); finally, you sprung the catch, Machinery. Once in a while, the victim came up with MacHinery. We were reminded of this acorn when a purchase order arrived from a brass company in Indiana ordering the latest copy of "MacHenry's Handbook." Evidently a facetious purchasing agent was taken literally by his order clerk.

Keeping Distance, Praise Be!

G.M.'s vice-president in charge of engineering stated recently that in designing automobiles to get increased slope on the back of the car, passengers are being moved forward. We were alarmed to think that the back-seat passenger would be breathing down the neck of the driver until the V.P. went on to say that the proper dimension for the distance between the front and rear passenger was being maintained.

Twenty-Nine Years After

City Tool & Die Co., Inc., Muncie, Ind., wrote to us: "We have been advised by the National Bureau of Standards that you had an article entitled 'How Precision Gage-Blocks are Made' in April, 1920, MACHINERY. Would it be possible for you to supply us with a copy?" It so happened that this article had been reprinted at the time by Pratt & Whitney, and we had exactly one somewhat yellowed copy on hand, which we forwarded.

Thomas Knows Best

Thumbing through the mountainous "Thomas' Register of American Manufacturers" on the trail of manufacturers of machinery for the production of automobile springs, we were stopped short by this heading: "Drips—All Kinds in One List."

Endorsement Sent No Arm was Bent

From Medellin in Colombia, S. A., an enthusiastic correspondent wrote: "Last year I have bought at Brighton, England, your MACHINERY'S HANDBOOK, Thirteenth Edition, and I am only too glad to admit that it is one of the best books that ever came into my hands. And this certainly shall admit any other mechanical engineer."

Metal Chippies?

Steelways notes a report that New Jersey sparrows had raided a machine shop to get stainless-steel shavings for a nest.

News of the Industry

California and Texas

JACK BREWER, 1060 S. Broadway, Los Angeles 15, Calif., has been appointed representative of the Whiton Machine Co., New London, Conn., manufacturer of lathe chucks, centering machines, special-purpose high-production milling machines, and gear-cutting machines.

RUCKER Co., specializing in the application of fluid power units and systems for industrial use on the Pacific Coast, has moved its branch office in Los Angeles, Calif., to larger quarters at 1855 Industrial St. This office was formerly located at 3312 W. Vernon Ave.

WESTCOTT CHUCK Co., Oneida, N. Y., announces the appointment of HERMAN H. HOBELMANN, 744 Harrison St., San Francisco, Calif., as its district representative in California, Oregon, Washington, and the Reno district of Nevada.

JAMES F. CROUGH, 607 Market St., San Francisco, Calif., has been appointed western representative for the Hydraulic Power Division of the Hydraulic Press Mfg. Co., Mount Gilead, Ohio.

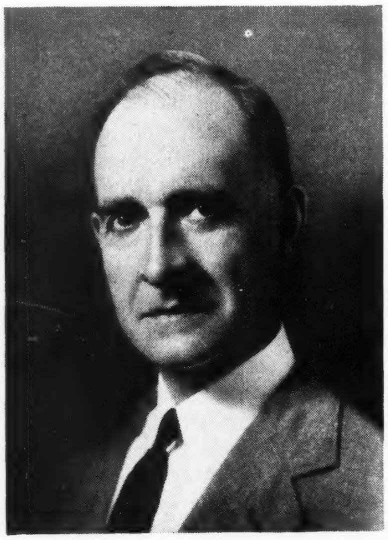
LINK-BELT Co., Chicago, Ill., announces that it has recently opened a plant containing approximately 45,000 square feet of floor space at 3203 S. Wayside in Houston, Tex. ALLAN CRAIG, formerly located at the Link-Belt plant in Atlanta, Ga., is general manager of the company's Southwestern Division, with headquarters at the Houston plant.

Connecticut and Massachusetts

HARTFORD SPECIAL MACHINERY Co., Hartford, Conn., announces the appointment of the following agents for its line of automatic drilling and tapping machines, swagers, thread rollers and die polishing machines: JOSEPH WINDHEIM, Rochester, N. Y.; and LLOYD & ARMS INC., 3818 Chestnut St., Philadelphia, Pa.

M. K. PECK has been appointed to supervise and activate sales of the Bullard-Universal horizontal boring machine line recently acquired by the Bullard Co., Bridgeport, Conn. From 1935 to 1947 Mr. Peck was connected with William Sellers & Co., of Philadelphia, Pa., in a sales and service engineering capacity. In 1947, when the Consolidated Machine Tool Corporation, of Rochester, N. Y., absorbed the William Sellers company, he was transferred to Rochester.

HARRY EMERSON SLOAN, president and treasurer of the Cushman Chuck Co., Hartford, Conn., celebrated the fiftieth anniversary of his association with the company recently. His activities began in the manufacturing department, and have progressed through engineering and administrative capacities to his present executive position. Mr. Sloan's father, Adrian P. Sloan, was one of the founders of the present organization.



Harry E. Sloan, who recently completed fifty years with the Cushman Chuck Co.

JOHN S. TAWRESEY has joined the Barden Corporation, Danbury, Conn., manufacturer of precision ball bearings. He was formerly vice-president in charge of engineering at the Bunting Brass & Bronze Co., Toledo, Ohio.

ELMER J. MLINAR has been made assistant works manager of the Yale & Towne Mfg. Co., at Stamford, Conn.

R. Y. FERNER Co., 110 Pleasant St., Boston 48, Mass., has been appointed agent in the United States for the line of material testing machines built by Carl Schenck of Darmstadt, Germany.

RAYMOND A. COLE has resigned as vice-president of the Pope Machinery Corporation, Haverhill, Mass. His future plans have not yet been announced.

Illinois and Indiana

BULLARD Co., Bridgeport, Conn., manufacturer of machine tools, recently appointed H. EDWARD NEALE as Chicago representative, working in conjunction with the MARSHALL & HUSCHART MACHINERY Co., 571 Washington Blvd. at Jefferson St., Chicago, Ill. He takes the place left vacant by the death of George York.

RANDALL GRAPHITE BEARINGS, INC., Chicago, Ill., has purchased the foundry and machine shop of the SHOOK BRONZE CORPORATION at Lima, Ohio. It is planned eventually to transfer the Chicago plant to Lima. The new plant will be known as the SHOOK BRONZE DIVISION OF RANDALL GRAPHITE BEARINGS, INC.

AMERICAN PULLMAX Co., INC., has been formed at 2627 North Western Ave., Chicago 47, Ill., to handle the sales and service of the new Pullmax sheet-steel and plate cutting machine. The president of the company is STELLAN BENDZ, and the sales manager, E. G. KIHLSTROM.

E. O. HOWARD has been appointed sales engineer for the Grinder and Titan Abrasive Divisions of Charles H. Besly & Co., Chicago, Ill., in the northern Illinois territory. For the last eleven years he has been manager of the Buffalo, N. Y., territory.

COMMERCIAL FILTERS CORPORATION, Boston, Mass., manufacturer of Fulflo filters has opened a mid-western sales office at 603 W. Washington Blvd., Chicago, Ill., with WALTER H. MAGEE in charge.

RICHARD H. BANCROFT has been appointed executive engineer for the Perfect Circle Corporation, Hagerstown, Ind. Mr. Bancroft was previously castings plant manager for the corporation, in charge of both the foundry at New Castle, Ind., and the sleeve castings plant at Richmond, Ind. He will be succeeded by DALLAS F. LUNSFORD as head of the foundry, and by ROBERT C. MYERS as head of the sleeve castings plant, both men having been assistant managers prior to their promotion.

Maryland and West Virginia

LAWRENCE M. RICKETTS, JR., has been elected vice-president and assistant treasurer of the Poole Foundry & Machine Co., Woodberry, Baltimore, Md., manufacturer of flexible couplings, gears, and special types of machines.

CARBOLOY COMPANY, INC., Detroit, Mich., has appointed the W. L. REYNOLDS Co., 502 W. Franklin St., Baltimore, Md., distributor of Carboloy tools in Baltimore and vicinity.

S. C. WOOD and K. P. HOUSE have been appointed assistant managers of the Tubular Sales Division of the Wheeling Steel Corporation, Wheeling, W. Va.

Michigan

BEN F. BREGI, executive engineer of the National Broach & Machine Co., Detroit, Mich., and CHARLES C. CLINTON, sales engineer in the same organization, sailed September 29 on an extensive trip to visit automotive, machine tool, and marine engine manufacturers in Great Britain, France, Holland, Switzerland, Sweden, Italy, and Western Germany. Mr. Bregi will lecture on modern methods of gear manufacture before organizations of engineers and production men in the principal industrial centers of Europe. He is a member of the Automotive Gearing and Gear Cutting Tools Committees of the American Gear Manufacturers' Association, and secretary of the Gear Equipment Group of the National Machine Tool Builders' Association.

Ben F. Bregi who is making an extensive tour of Europe, lecturing on modern gear manufacturing methods

H. S. Peters, newly appointed central district sales manager of Giddings & Lewis Machine Tool Co.

H. S. PETERS has been appointed central district sales manager of the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., succeeding the late A. E. Ulrich. Mr. Peter's headquarters will be at Detroit, Mich.

ROTOR TOOL Co., Cleveland, Ohio, has appointed the RUSSELL & OLSON Co., 15815 James Couzens Highway, Detroit 21, Mich., agent for the company in the Detroit, Toledo, and Michigan areas. JOSEPH RICHARDS, the Rotor Tool representative in the Detroit area for the last five years, will be associated with the Russell & Olson Co.

BAY STATE ABRASIVE PRODUCTS CO., Westboro, Mass., announces that the Detroit branch office and warehouse of the company have been moved to larger quarters at 880 Lawndale Ave., Detroit 9, Mich. A new grinding wheel alteration service is available at this office for the convenience of customers in the Michigan area.

J. F. HAWKINS has been appointed district sales manager in the Detroit territory for the Page Steel and Wire Division of American Chain & Cable Co., Inc., with headquarters in the General Motors Building, Detroit, Mich. He was previously stationed at Pittsburgh.

FRANCIS J. SEHN has been added to the sales engineering staff of the Clearing Machine Corporation, Chicago, Ill., manufacturer of presses. His headquarters will be at Detroit, Mich. Mr. Sehn was previously chief die engineer for the Fisher Body Tank Division.

New Jersey

JOHN T. WETZEL has been appointed plant manager of the Tube Reducing Corporation, Wallington, N. J., maker of specialty seamless tubing. He was formerly assistant to the president of the Curtiss Wright Corporation.

FRANK G. HELANDER has been appointed executive vice-president of the Watson-Stillman Co., Roselle, N. J., manufacturer of hydraulic machinery. He was previously mid-west sales manager of the Hydraulic Machinery Division, with headquarters in Chicago.

WILLIAM G. GUNLACK has been made sales representative of the A. B. Murray Co., Inc., Elizabeth, N. J., distributor of steel and tubes, and JOHN J. LUSSEN has joined the sales department. Both men will specialize in stainless-steel products.

C. K. BANKS has been named director of research of the Metal & Thermit Corporation, New York City. His headquarters will be at the company's research laboratory at Woodbridge, N. J.

New York

EDWARD C. BAILEY has announced the termination of his connection as eastern district manager of the Greenfield Tap & Die Corporation, Greenfield, Mass., with headquarters at 15 Warren St., New York City. He had been associated with the company for over thirty-one years in various capacities. After a short vacation, Mr. Bailey intends to become associated again with the small tool industry.

V & O PRESS CO., DIVISION OF ROCKWELL MFG. CO., Hudson, N. Y., announces the purchase of the patents, patterns, tools, and other equipment for the punch-press feeding device known as the "Feed-O-Matic" from the COVERT MFG. CO., Troy, N. Y. These machines will be built at the V & O Press Co.'s plant, and will be known as the "V & O Feed-O-Matic."

DICK M. LANDIS has been made assistant manager of the Industrial Division of the De Laval Separator Co., 165 Broadway, New York City. He was formerly manager of the industrial department of the De Laval Pacific Co., San Francisco, Calif., in which position he will be succeeded by ROBERT K. HOOD.

M. ADOLPH HEIKKILA, until recently with the New Jersey Zinc Co., New York City, announces the formation of a public relations consulting service at 35-15 Ninety-first St., Jackson Heights, Long Island, N. Y.

Louis R. Ripley, recently elected president of the Heli-Coil Corporation

LOUIS R. RIPLEY has been elected president of the Heli-Coil Corporation, 47-23 Thirty-fifth St., Long Island City, N. Y., manufacturer of Heli-Coil stainless-steel screw-thread inserts.

ERNEST H. PAULI, with offices in Manhattan and Newark, N. J., has been appointed industrial distributor in northern New Jersey, New York, and western Connecticut for the Atlas Chain & Mfg. Co., manufacturer of roller chain.

HAUSER MACHINE TOOL CORPORATION, Manhasset, N. Y., has been appointed United States representative for the line of precision lathes and other machine tools made by SCHAUBLIN LTD., Bevilard, Switzerland.

PHILLIP A. KESSLER has been made chief engineer of the Sage Equipment Co., Buffalo, N. Y., manufacturer of conveyor equipment.

Ohio

CINCINNATI LATHE & TOOL CO., Oakley, Cincinnati, Ohio, has acquired from the CANEDY-OTTO MFG. CO., Chicago Heights, Ill., its line of light upright, sensitive, and radial drills. All operations are being transferred from Chicago Heights to Oakley. This line of drilling equipment complements the line of light- and medium-duty "Tray-Top" engine lathes produced and marketed by the Cincinnati Lathe & Tool Co.

NON-FERROUS PERMA MOLD, INC., a new company jointly owned by the BARNES MFG. CO., of Mansfield, Ohio, and the NON-FERROUS DIE CASTING CO., LTD., of London, England, has been incorporated in the state of Ohio, with factories in Mansfield, Ohio, to manufacture copper-base alloy castings by the permanent-mold process. A number of special technicians who have been prominent in the British field of permanent-mold casting will be associated with the company at its plant in Mansfield.

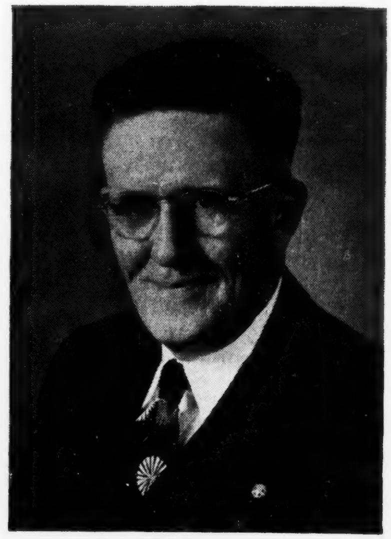
ROBERT KREPPS has been appointed district sales supervisor in the midwest area for the Denison Engineering Co., Columbus, Ohio. His headquarters will be at the company's Chicago office, 11047 S. Hale Ave. Mr. Krepps has been associated with the company for twelve years in engineering and sales capacities.

CINCINNATI ELECTRICAL TOOL CO., Cincinnati, Ohio, has recently acquired the HISEY-WOLF MACHINE CO., manufacturer of grinding machines and buffing and polishing lathes. The Hisey-Wolf products will be manufactured at the plant of the new owner.

HAL W. REYNOLDS CO., 2902 Euclid Ave., Cleveland, Ohio, has been appointed sales representative for the B. C. AMES CO., Waltham, Mass., manufacturer of micrometer dial indicators and micrometer dial gages.

GRIFFITH C. TAAFFE, sales manager of the Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio—a subsidiary of the CINCINNATI MILLING MACHINE CO.—has been elected a vice-president of the Cincinnati Lathe & Tool Co. Mr. Taaffe has been associated with the parent company since 1935 in both engineering and sales capacities. In 1947, he was made general sales manager of the Cincinnati Lathe & Tool Co., which position he continues to hold.

Griffith C. Taaffe, newly elected vice-president of the Cincinnati Lathe & Tool Co.



Milton T. Carleton, new works manager of the Cleveland Crane & Engineering Co.

MILTON T. CARLETON has been named works manager of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. He had previously been works manager of the Cleveland Division of the E. W. Bliss Co. for fourteen years.

W. L. VEIT has been appointed specialist on Crescent woodworking machinery for the Power Tool Division of the Rockwell Mfg. Co., Milwaukee, Wis. Mr. Veit was formerly sales manager of the Crescent Machine Co., and held that post after the company became a division of the Rockwell Mfg. Co. His headquarters will be at Leetonia, Ohio.

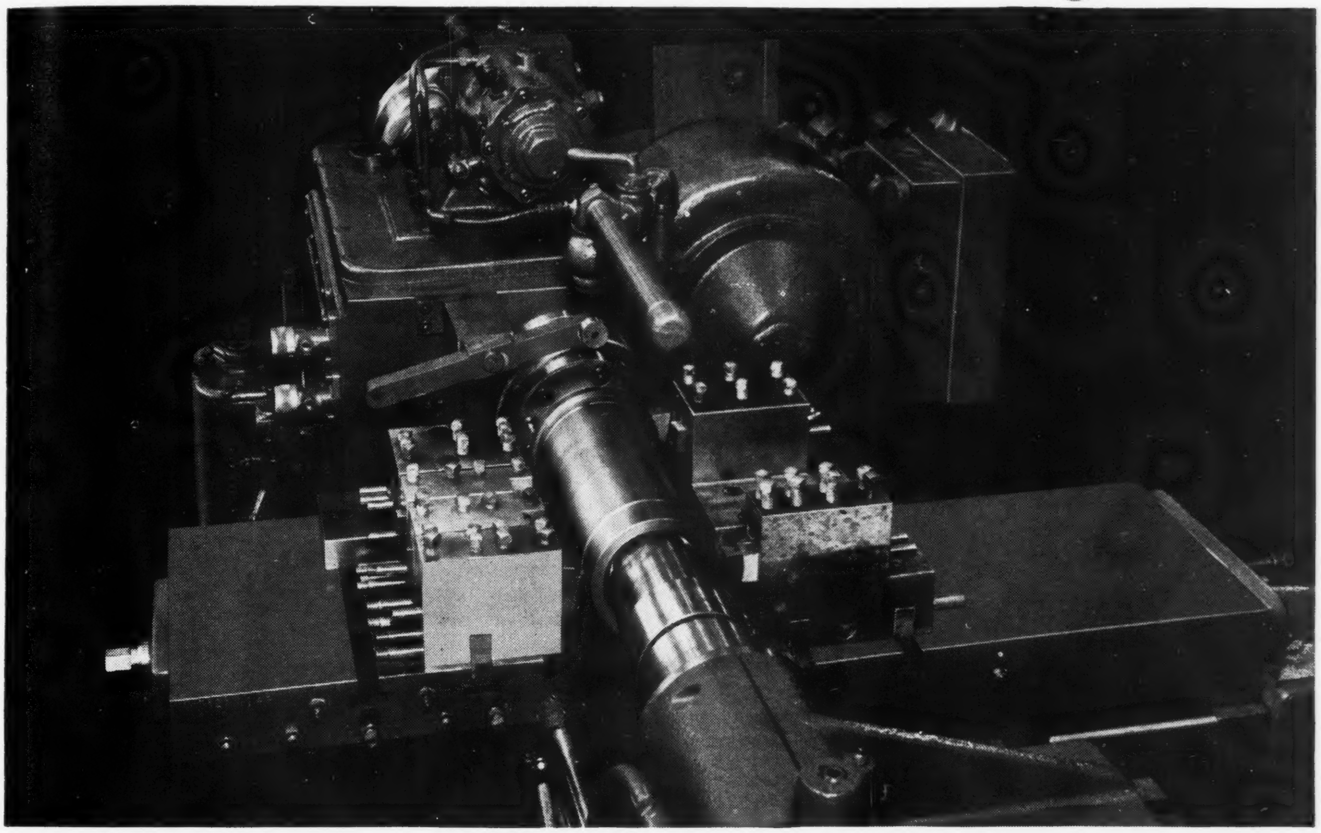
R. A. J. WELLINGTON has been made national sales manager of Precision Metalsmiths, Inc., Cleveland, Ohio, precision investment metal casters. Mr. Wellington was previously in charge of home-office sales for the company.

DAVID NEILL has been made Cincinnati sales representative for the line of gears, gear units, and flexible couplings manufactured by the Farrel-Birmingham Co., Inc.. Ansonia, Conn.

Pennsylvania

STANDARD PRESSED STEEL CO., Jenkintown, Pa., manufacturer of socket-screw products, self-locking nuts, and steel shop equipment, announces the following changes in its sales organization: GEORGE A. GADE, former district manager of the Detroit office and warehouse, has been appointed regional sales manager in charge of mid-west territories, with headquarters in Detroit. FRANCIS J. KIN-

CYLINDER LINERS:



17 different sizes on One Automatic Lathe

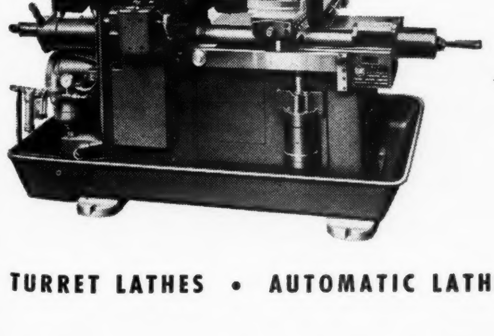
THE GISHOLT No. 12 HYDRAULIC

You wouldn't expect an automatic lathe to handle such a wide variety of work as this—unless you know the Gisholt No. 12 Hydraulic.

This versatile automatic lathe handles 17 different sizes of cylinder liners ranging from 6½″ to 13″ in length and from 3″ to 5″ in diameter. The work is chucked on expanding arbors with interchangeable pads, while the front and rear tooling is mounted in standard, interchangeable tool blocks. This arrangement provides exceptional flexibility and a facility to quickly change over from one job to another.

When you can handle as many different sizes of parts on *one* automatic lathe—and cut both machining and set-up time—you're *bound* to cut your costs.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin



Gisholt No. 12 Hydraulic Automatic Lathe—a rugged 12″ lathe that combines speed and accuracy with easy set-up — unique among automatics.

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

GISHOLT

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

SELLA succeeds Mr. Gade as Detroit district manager. DAVID J. HURFORD, Cincinnati area district manager, has been named special representative for aircraft products in the West Coast territory, and will be replaced at Cincinnati by WILLIAM C. HARPER, formerly New England representative. A. CLAYTON GRAHAM takes Mr. Harper's place in the New England territory.

RAY H. TIMMONS has been appointed manufacturing manager of industrial products for the Westinghouse Electric Corporation, Pittsburgh, Pa. Mr. Timmons was formerly manager of manufacturing for the company's Transportation and Generator Division at East Pittsburgh, and will be succeeded in that position by C. M. CLARK, previously superintendent of manufacturing of the division.

S. J. WOODWORTH has been appointed sales manager of the Wright Hoist Division of the American Chain & Cable Co., Inc., with headquarters at York, Pa. He succeeds A. R. HASKINS, who has resigned to establish a business in Milwaukee. Mr. Woodworth has been with the Wright Hoist Division for over twenty-five years.

LESTER, HANKINS & SILVER is a new partnership formed for the purpose of helping builders and distributors of machinery, equipment, and technical products in their management, distribution, and sales problems. The company maintains offices at 16 DS Race St., Philadelphia 3, Pa., and 140 Cedar St., New York 6, N. Y. BERNARD LESTER, sales management engineer and formerly manager of the resale department, Westinghouse Electric Corporation, is president of the company. The other partners are FRANK W. HANKINS, industrial sales and marketing counselor of Hankins-Borie & Associates; and JOHN A. SILVER, formerly executive vice-president and director of the F. J. Stokes Machine Co.

Bernard Lester, president of the new partnership of Lester, Hankins & Silver

B. J. FLETCHER has been named assistant chief hydraulic engineer for the Aluminum Co. of America, Pittsburgh, Pa. Mr. Fletcher joined the company in 1926 as a member of the hydraulic engineering department. In 1931, he was transferred to the development division and was made chief engineer of that division in 1944.

SIMONDS ABRASIVE CO., Philadelphia, Pa., announces the opening of branch offices and warehouses at 8829 Hubbell Ave., Detroit, Mich., and 1350 Columbia Road, Boston, Mass. Stocks of grinding wheels and abrasive grain will be carried at the new branches to supplement the service of the company's regular distributors.

BALDWIN LOCOMOTIVE WORKS, Philadelphia, Pa., has announced the purchase of the press business of the DEFIANCE MACHINE WORKS, INC., Defiance, Ohio. All models of the Defiance preform presses will now be manufactured under the Baldwin-Defiance name at the Baldwin Eddystone, Pa., plant.

H. L. R. EMMET, for the last twenty-one years works manager of the General Electric Co.'s works at Erie, Pa., retired on October 1, and has been succeeded by BERTRAM MILLER, assistant manager.

WILLIAM F. CHASE, president and treasurer of the Bearing Service Co., Pittsburgh, Pa., has been elected president of the Smaller Manufacturers' Council of Pittsburgh.

GEORGE C. STAMETS has joined the William K. Stamets Co., Pittsburgh, Pa., machine tool distributor, in the capacity of sales engineer.

Wisconsin and Minnesota

FREDERICK WENZEL has been made works manager of the Trent Tube Co., East Troy, Wis., and W. C. CHRISTIANSON has been appointed sales manager. Mr. Wenzel was formerly plant superintendent, and Mr. Christianson was assistant sales manager.

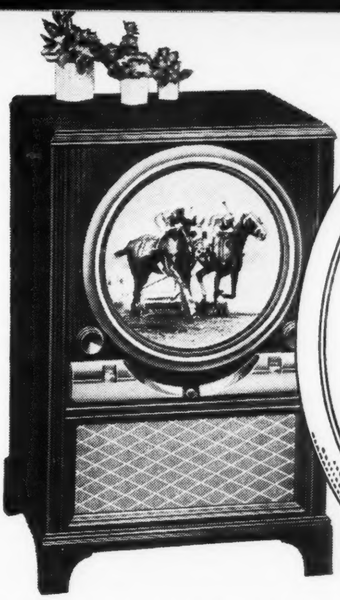
GEORGE GORTON, III, executive vice-president and general manager of the George Gorton Machine Co., Racine, Wis., manufacturer of precision machine tools, has been appointed a member of the American Management Association's Production Council.

George Gorton, III, recently appointed a member of the American Management Association's Production Council

WILLIAM J. SPARLING has been elected vice-president and manager of the Chain and Transmission Division of the Chain Belt Co., Milwaukee, Wis. Mr. Sparling joined the company in 1928 as a student engineer. Prior to his present appointment, he was works manager, in which position he is now succeeded by E. P. MEYER, former assistant works manager. ROSCOE O. BYERS has been made factory manager of the Chain and Transmission Division, and CLARENCE B. RINGHAM factory manager of the Heavy Machintion Council. The Council guides the Association's activities in the production field.

LINK-BELT CO., 307 N. Michigan Ave., Chicago 1, Ill., announces the opening of a district sales office at 422 Board of Trade Bldg., 301 W. First St., Duluth 2, Minn. JOHN E. MORRISON, formerly district sales engineer at Chicago and Minneapolis, has been appointed district manager in charge of the new office. He will be assisted by HAROLD A. IVARSON, who has been transferred from the Minneapolis plant.

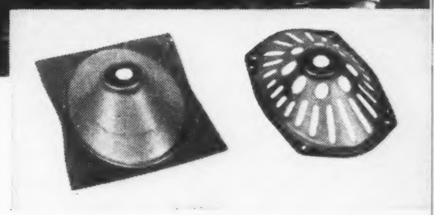
WILLIAM L. MCKNIGHT, president since 1929 of the Minnesota Mining & Mfg. Co., St. Paul, Minn., has been elected to the newly created post of chairman of the board. He will be succeeded in the presidency by RICHARD P. CARLTON, who was former executive vice-president in charge of research, engineering, and manufacturing.



Over 80% of the presses at Zenith Radio —are Bliss!

The *St. Regis*, a triumph of Zenith's television design and engineering, contains a variety of stampings made on Bliss presses.

Complex die in Bliss No. 28 Press punches 35 holes in automobile radio speaker and trims outside area. Material is 20 gauge steel. Press operates at 45 S.P.M.



First and second operation samples of punching and trimming automobile speaker. Blank is drawn to full depth and center hole pierced in first operation on 75-ton new Bliss Inclinable.

When Zenith Radio Corporation needs presses for the thousands of stampings that go into their extensive line of radios and television sets, hearing aids, and automotive radios—*they specify Bliss.*

W. Dumke, Vice President of Zenith, and O. Westad, Press Room Supervisor, have been able to compare the performances of many different makes of presses in their long radio manufacturing experience. That's why 80 per cent of Zenith's stamping equipment, *and over 95 per cent of the presses purchased in recent years,* have been supplied by Bliss. These include batteries of straight side, inclinable, and horning presses.

More reasons? Let's look at the record. In 1947, Zenith installed 40 new Bliss presses and has used them ever since, mostly on short press runs requiring frequent die changeovers —*without mechanical difficulty*. The Bliss Inclinables, which are being used currently to stamp out parts for the Zenith television sets, are "a happy combination of ruggedness and simplicity," according to Dumke and Westad. They regard highly, too, the Bliss Rolling Key Clutch—for its dependability and speed of action.

This overwhelming preference for Bliss equipment at Zenith is duplicated in every major pressed metal industry...from one end of the production line to the other. Bliss supplies not only a press, but also a 90-year fund of engineering and production knowledge designed to help *your* plant...as it has helped plants like yours...solve its production problems. It will pay you to send for a Bliss sales engineer today.

E. W. BLISS COMPANY, TOLEDO 7, OHIO

Mechanical and Hydraulic Presses, Rolling Mills, Container Machinery

WORKS AT: Toledo, Salem, Ohio; Hastings, Michigan; Derby, England; St. Ouen sur Seine, France

Battery of Bliss No. 21½ Inclinable Presses stamp out parts for radio, television sets, and hearing aids at Zenith. Bliss straight side and horning type presses round out Zenith's production line.

ASK ABOUT OUR NEW DEFERRED PAYMENT PLAN

1-3 years to pay

25% down

3¼% average yearly interest on original balance

No finance charges

BLISS BUILDS MORE TYPES AND SIZES OF PRESSES THAN ANY OTHER COMPANY IN THE WORLD

MARQUETTE · BLISS · CONSOLIDATED · BLISS BUILT · TOLEDO

Obituaries

Douglas B. Hobbs

Douglas B. Hobbs, for twenty-six years associated with the Aluminum Co. of America, Pittsburgh, Pa., died suddenly on October 11, following a heart attack, at the age of forty-nine years. At the time of his death he was attending a convention of the Association of National Advertisers in New York City.

Mr. Hobbs was born in Nebraska City, Neb., in 1900. He received his bachelor of arts degree from the University of the South, Sewanee, Tenn., after which he did graduate work in metallurgy at Lehigh University. In 1923, Mr. Hobbs joined the Aluminum Co. of America as a research metallurgist at the Cleveland branch of the Research Laboratories, and the following year was transferred to the metallurgical division of the company's Cleveland Works.

In 1929, he became associated with the company's public relations and advertising department in Pittsburgh. During his twenty years in this department, "Barney" Hobbs gained wide recognition for his numerous technical and general writings on aluminum and for his work as producer of the company's motion pictures, and as director of its educational programs. Mr. Hobbs is survived by his wife and two daughters.

Warren J. Hannum

Warren J. Hannum, for over thirty-five years associated with the machine tool industry, died recently at the age of sixty-five. Mr. Hannum was born in Wisconsin on January 2, 1884. He started work with the Gisholt Machine Co. in Madison, Wis., in 1905. After three years of service, he was transferred to the Warren, Pa., plant as general manager, which position he held until 1915, when he returned to Madison.

In 1921, he was appointed general manager of the Milholland Machine Tool Co., Indianapolis, Ind., but returned to Madison when the Gisholt Machine Co. brought out the Milholland organization. He joined the Libby Division of International Detrola Corporation in June, 1940, and served as vice-president and general manager of that concern until his retirement following a serious automobile accident. He is survived by his wife and a daughter.

George Robert York, of Park Ridge, Ill., salesman for the Bullard Co., Bridgeport, Conn., died on September 25, after a short illness, at the age of thirty-seven. Mr. York was born in Monticello, N. Y., on August 10, 1912. Following his graduation from the Monticello high school, he was employed by the Heppenstall Co., Bridgeport, Conn., as a machine operator. In 1937, he became associated with the Bullard Co., starting as a boring mill operator and shortly afterward being promoted to demonstrator. Five years later, he was transferred to the Chicago office as sales engineer. Mr. York is survived by his wife and three sons.

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Sheffield Corporation Offers Class-Room Charts on Gaging Equipment

During the late war, the Sheffield Corporation, Dayton 1, Ohio, published a number of sets of class-room charts entitled "Dimensional Control, Theory, and Industrial Application," bound in a rigid easel cover, to aid in teaching war-time inspectors the importance of mechanical gaging equipment and how to use it. A 24-page booklet containing the instructor's teaching outline supplemented the charts. There are forty-six charts in the set, 28 by 32 1/2 inches, all fully illustrated. A few of these sets are left, which the Sheffield Corporation will send without charge to those teachers or schools that apply before the supply has become exhausted.

* * *

Herbert Hoover will be presented with the Frederick W. Taylor Key at the annual banquet of the Society for Advancement of Management, which will be held at the Hotel Statler, New York City, November 3. The Taylor Key is presented annually for an outstanding contribution to the advancement of the art and science of management. Mr. Hoover will receive it in recognition of his services as chairman of the Commission on Organization of the Executive Branch of the Government.

Coming Events

November 10-11 — Production Conference of the American Management Association at the Palmer House, Chicago, Ill. Public Relations Director, Edward K. Moss, 330 W. 42nd St., New York 18, N. Y.

November 28-December 2 — Annual meeting of the American Society of Mechanical Engineers at the Hotel Statler, New York City. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

November 30-December 2 — Annual meeting of the Society for Experimental Stress Analysis at the Hotel New Yorker, New York City. For further information, address the Society, Box 168, Cambridge 39, Mass.

January 16-19, 1950 — First Plant Maintenance Show in the Auditorium, Cleveland, Ohio. Further information can be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

February 27 - March 3, 1950 — Spring meeting of the American Society for Testing Materials at the Hotel William Penn, Pittsburgh, Pa. Executive Secretary, C. L. Warwick, 1916 Race St., Philadelphia 3, Pa.

March 28-31, 1950 — Fourth National Plastics Exposition at the Navy Pier, Chicago, Ill. Sponsored by the Society of the Plastics Industry. William T. Cruse, executive vice-president, 295 Madison Ave., New York 17, N. Y.

April 10-14, 1950—Exposition of the American Society of Tool Engineers at the Convention Hall and Commercial Museum in Philadelphia, Pa. Details available upon request to the Exposition headquarters, American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

June 26-30, 1950—Annual meeting of the American Society for Testing Materials and Ninth Exhibit of Testing Apparatus at the Chalfonte-Haddon Hall, Atlantic City, N. J. Executive Secretary, C. L. Warwick, 1916 Race St., Philadelphia 3, Pa.

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Paris Fair to Take Place in May

The annual Paris Fair, which attracted 10,000 foreign visitors in 1949 and included exhibits from fifteen foreign nations, will take place from May 13 through May 29 in 1950. The exhibits at this Fair cover every branch of French and international industrial, commercial, and agricultural production.

New Books and Publications

How to Cut Production Costs. Edited by H. E. Blank, Jr., Editor, *Modern Industry*. 384 pages, 5 1/2 by 8 inches. Published by the Funk & Wagnalls Co., 153 E. 24th St., New York 10, N. Y. Price, $4.50.

Tested techniques for reducing production costs are described in this book, the material having been gathered from both large and small manufacturers by the staff members of *Modern Industry*. The purpose is to stimulate thought on the subject, as well as to present practical ideas that can be applied to the improvement of production operations. The material is divided into three main parts as follows: Part I, Modern Production Methods; Part II, Modern Production Techniques and Equipment; and Part III, Modern Plant Maintenance Services and Working Conditions. Many of the chapters include check-up charts, the purpose of which is to reveal both weak and strong points of existing plant operations, from maintenance to cost control.

Metal Finishing Guidebook-Directory. 468 pages, 5 by 7 3/4 inches. Published by Finishing Publications, Inc., 11 W. 42nd St., New York 18, N. Y. Price, $2.

The eighteenth annual edition of a guidebook and directory for the metal finishing field contains a vast amount of practical information on electroplating, cleaning, polishing, buffing, and related subjects. It covers finishing plant engineering, including the lay-out of plating rooms, heating methods for plating solutions, automatic controls for plating tanks, and similar material; abrasive methods; cleaning, pickling, and electropolishing; plating solutions; surface treatments; and control and testing. The book includes a directory of suppliers and manufacturers of equipment and materials for metallic surface treatments, classified both according to product and alphabetically by firm name. There is also a list of trade names of products used in this field.

Taper Calculation and Inspection. 74 pages, 5 1/2 by 8 1/2 inches. Published by the Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Obtainable through The Industrial Press, 148 Lafayette St., New York 13, N. Y. Price, 3/6.

Those concerned with the production of taper parts that have to engage accurately within close limits will be interested in this new booklet—No. 25 in the Yellow-Back Series—which contains a complete discussion of the subject. It presents fundamental formulas for calculating tapers; describes universal taper measuring gages and inspection gage-blocks, as well as methods of gaging taper fit assemblies; and discusses angular tolerances of taper plug and ring gages and their effects. Tables especially compiled to facilitate calculation are included. The final chapter deals with additional simple methods of checking tapers.

Machine Tool Selling. By Harry J. Loberg. 194 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $3.50.

Summarizing the sales refresher course sponsored by the National Machine Tool Builders' Association and the American Machine Tool Distributors' Association, this guide covers all phases of machine tool selling, including buying motives; methods of customer approach; the interview; sales presentation; meeting objections; closing and following through the sale; and many other practical selling methods and techniques. Special chapters are devoted to market analysis, selection of equipment, economics of installation, selling to the Government, and the relationship between the machine tool distributor and the machine tool builder.

Technical Drawing. By Frederick E. Giesecke, Alva Mitchell, and Henry Cecil Spencer. 851 pages, 6 by 9 inches. Published by the Macmillan Co., 60 Fifth Ave., New York 11, N. Y. Price, $4.50.

This is the third edition of a work intended as a class text and reference book on technical drawing. It contains a large number of problems covering every phase of the subject, and constitutes a complete teaching unit in itself. The present edition has been completely revised, and a large part of the text matter has been rewritten. A number of new illustrations and problems have also been added, and the book has been brought into agreement with the latest revision of the American Standard Drawings and Drafting-Room Practice.

Conveyors and Related Equipment. By Wilbur G. Hudson (Second Edition). 468 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $7.

The science of handling materials is comprehensively treated in this book, which comprises a guide to the factors that must be considered in buying, equipping, operating, and maintaining conveyors and related equipment. Among the additions included in this edition are a discussion of pneumatic conveying; dust explosion hazards; recent technical improvements that increase the capacity of belt conveyors; and applications of motorized industrial trucks.

Induction Heating. By N. R. Stansel. 212 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $3.50.

The aim of this book is to present the electrical and thermal principles of the use of eddy currents for heating service and to show how these principles are applied in practice. The book also indicates the procedures for the development of new uses of this method of heating. The subject is discussed under the following headings: Heat; Induction Heaters; Circuit Equations; Circuit Analysis; Applications; Melting Metals; and Power Circuit Conductors—Machine Frequencies.

Manual of Time Study for Supervisors. By Robert L. Thomas. 91 mimeographed sheets, 8 1/2 by 11 inches. Published by the author, 4409 Abbott Ave., N., Minneapolis 22, Minn. Price, $2.20.

The text of this manual was used by the author in training groups of foremen in the machinery manufacturing field. It covers the background of time study; employe compensation; methods analysis; steps in taking the time study; and procedures and considerations in time study.

New Magnesium Alloys. 243 pages. Obtainable through the Library of Congress, Photoduplication Service, Publication Board Project, Washington 25, D. C. Price in photostatic form, $31.25; in microfilm, $9.

This is a comprehensive survey of the mechanical properties of some 200 alloys in forty magnesium-alloy systems, representing the results of a study undertaken by the Rensselaer Polytechnic Institute for the Air Force.

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In the first six months of 1949, the automotive industry produced almost 3,000,000 new cars, trucks, and buses—nearly as many units as were turned out in the full year of 1946. A steady increase has been registered since the industry surmounted its reconversion problems. In 1947, a 55 per cent production gain was made, compared with the preceding twelve months, and in 1948, a 10 per cent gain was registered over the previous year. The first half of the present year is up 20 per cent, compared with the first six months of 1948.